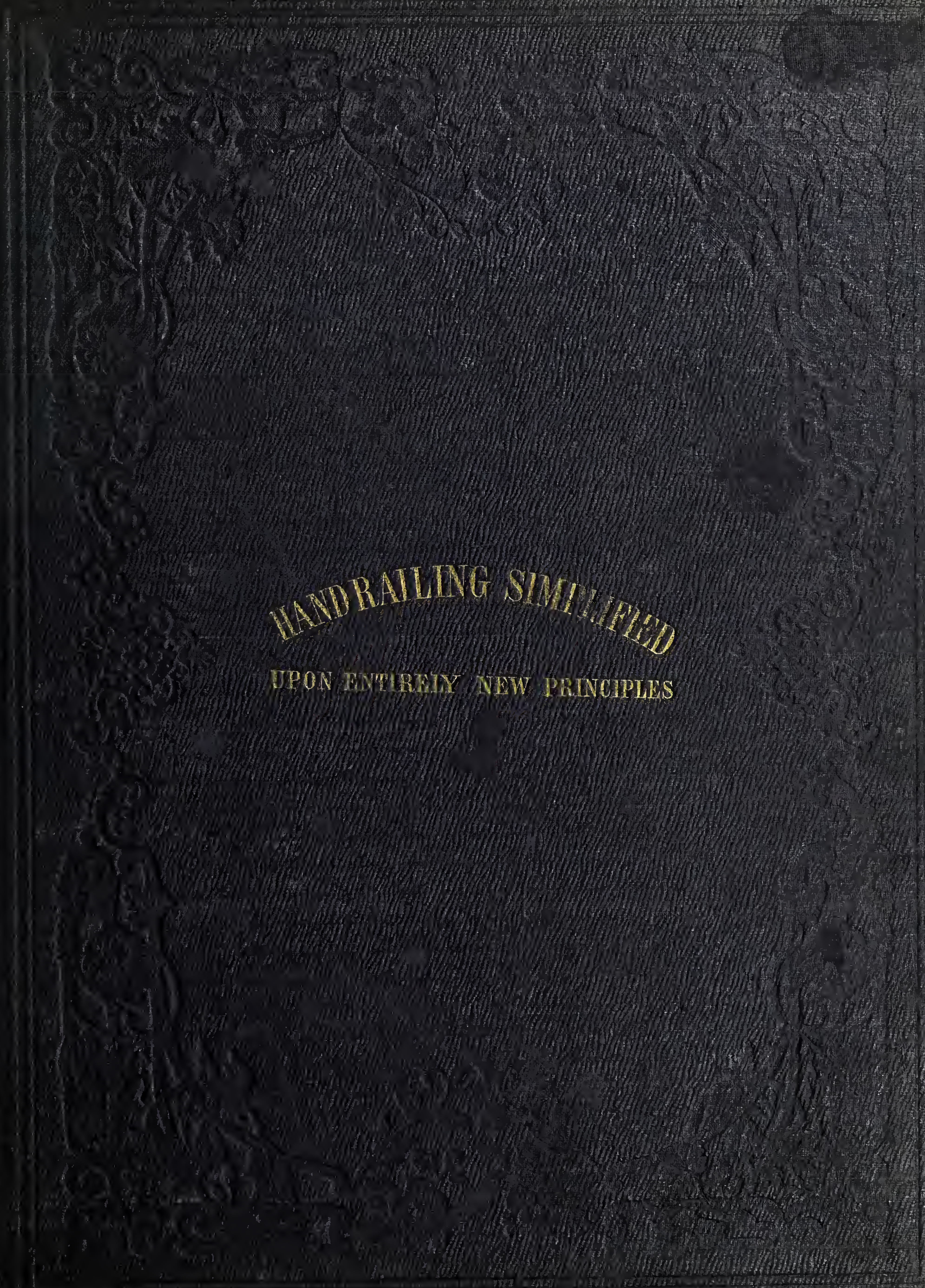


HANDRAILING SIMPLIFIED

UPON ENTIRELY NEW PRINCIPLES

1803 - 1860

Digitized by the Internet Archive
in 2019 with funding from
Getty Research Institute

https://archive.org/details/elementsofhandra00ridd_0

THE

ELEMENTS OF HAND-RAILING.

BEING

THE MOST COMPLETE AND ORIGINAL EXPOSITION
OF THIS BRANCH OF CARPENTRY,

THAT HAS APPEARED.

BY ROBERT RIDDELL.

THIRD EDITION, ENLARGED AND IMPROVED.

PHILADELPHIA:
JAMES CHALLEN & SON: LINDSAY & BLAKISTON,
NO. 25 SOUTH SIXTH STREET.
1860.

ADVERTISEMENT TO THE THIRD EDITION.

Stimulated by the extraordinary success of the publication and sale of the "Elements of Hand-railing," both in this country and in England, its author has been induced to issue a volume greatly enlarged, and which may be justly considered a text book; further improvment being utterly impossible. It may be proper to state, that however valuable my former publications on this branch of Carpentry may have been, the work now offered differs in its whole design and execution, from all that have preceded it. It purports to be radically and essentially new, original, unborrowed, and perfectly independent. To solicit indulgence for again appearing before the public, would be a paltry affectation of modesty, equally unavailing and misplaced. My aim from the first, was to establish a pure and infallible principle by which hand-rails could be constructed, with as much rigid nicety and certainty, as that of any other part of carpentry. To this end, after the most careful study and reflection, I have the proud satisfaction to announce the complete and successful invention of an entire new set of lines, by which the art of Hand-railing is reduced to a perfect system of simplicity, never before attained.

It is a source of personal gratification, that the demand for another edition of this work has enabled the author, by a careful revisal, to render the description by which it is elucidated, clear and explicit, and everything that was thought to be superfluous thrown aside. During the past five years, numerous authors have written on this subject, and all of them, without a single exception, have deemed my first publication lawful plunder. The most remarkable of these empirical productions appeared in New York, said to have been written whilst its authors were under the influence of spiritualism. No objection could be made to this, had the spirits confined themselves to that which was literally true and original, but unlike mortals, they have shown on every page the most positive evidence of thievery, and a sovereign contempt for all copy-right laws. However, the transcendent ability of the authors must be admitted, from the fact that nearly the whole of the letter-press description is written in typical, allegorical, parabolical, metaphorical, and *diabolical* language. The plates and drawings also exhibit these gentlemen to be profoundly versed in the abstruse and secret science of Egyptian hieroglyphics.

Thus have I ventured to give my opinion of rivals and competitors, with no wish to raise myself at the expense of others, but to respectfully invite a comparison to what has been done for the improvement of this art, and a critical examination of my claims and pretensions to preference. Before concluding, I beg to acknowledge my thanks to the builders and carpenters on both sides of the Atlantic, for the generous and liberal patronage which they have been pleased to bestow upon my efforts, in the elucidation of a branch that has heretofore been considered a difficult one.

3 Wellington St., Goswell Road, London.
1860.

Entered, according to Act of Congress, in the year 1860, by Robert Riddell, in the Clerk's Office of the District Court, for the Eastern District of Pennsylvania.

THE GETTY CENTER

PLATE I

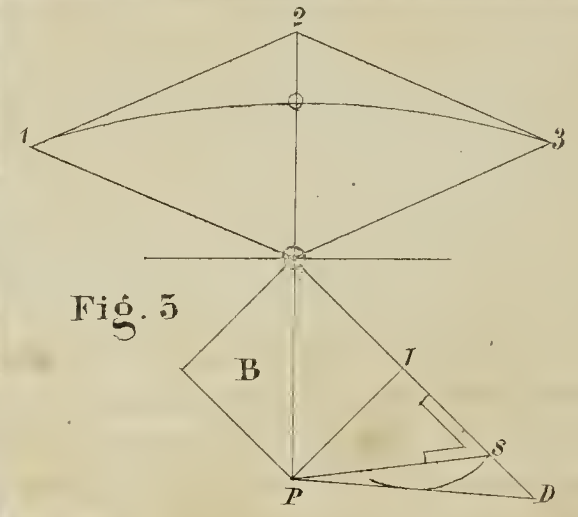


Fig. 3

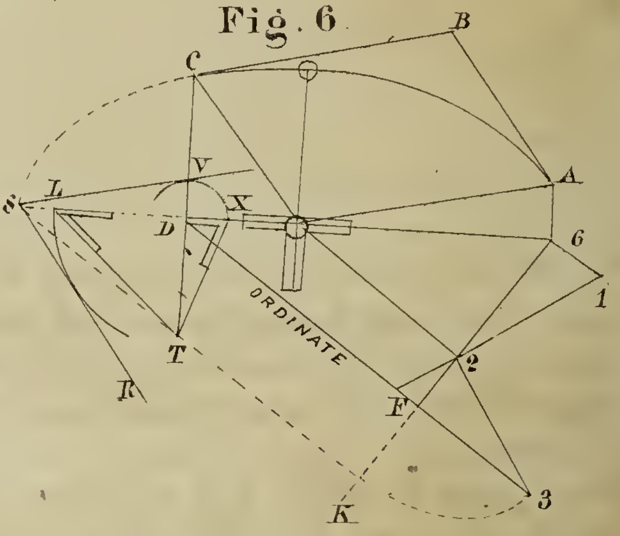


Fig. 6

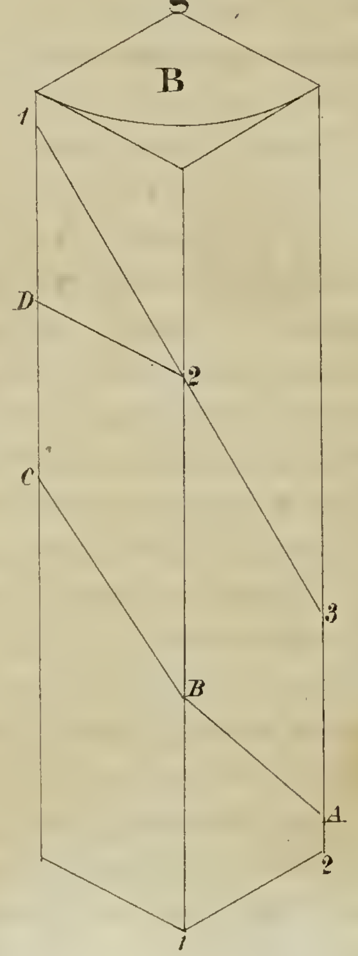


Fig. 2.

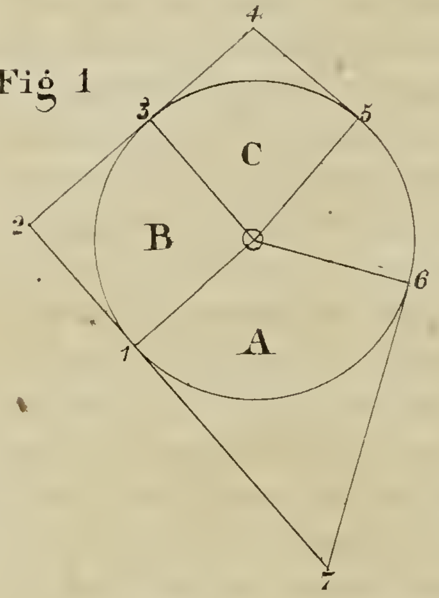


Fig 1

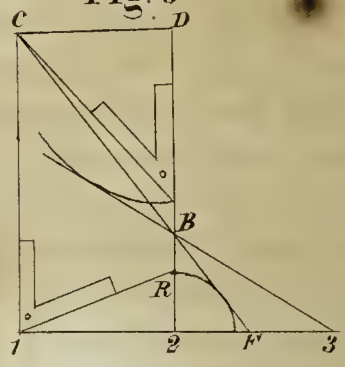


Fig. 5

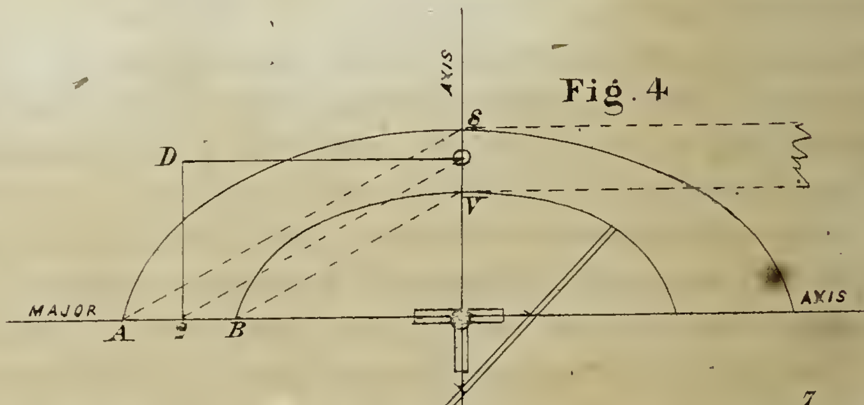


Fig. 4

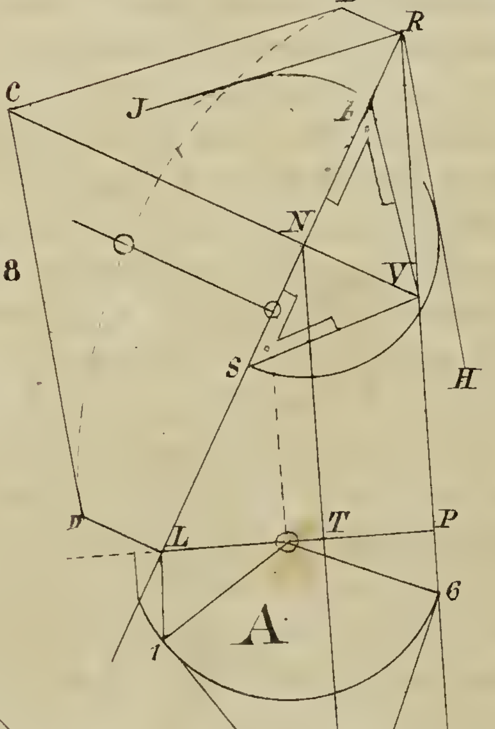


Fig 8

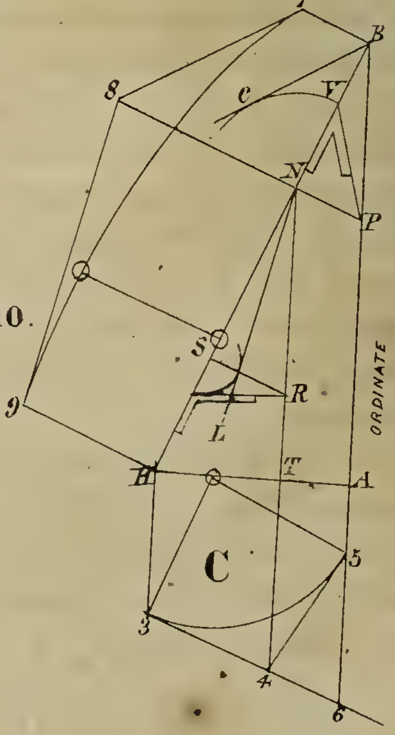


Fig. 10.

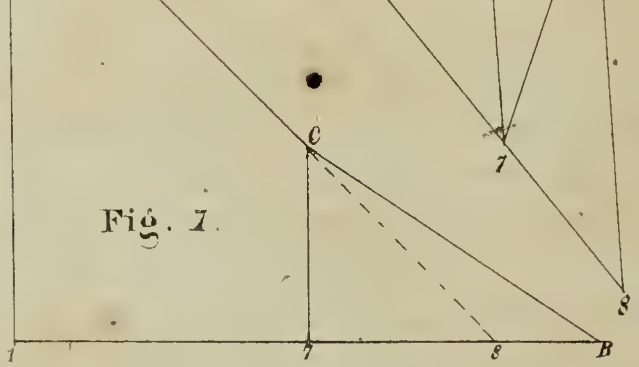


Fig. 7.

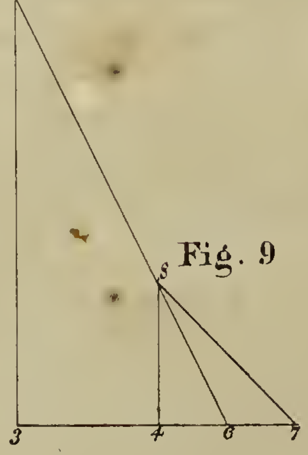


Fig. 9

R. Riddell

PLATE I.

THE diagrams on this plate will clearly and truly explain the whole art of Hand-railing. The pupil is earnestly requested not only to carefully examine the figures, but draw them. On these conditions, we promise him the most complete success in understanding every line in this work. It may be well to mention, that the proper construction of every face mould depends on tangents, and these in no case can be made to assume more than three angles, that is to say, the right angle, the obtuse, and acute angles; I will also remark, that the plank for a hand-rail, when cut, its surface can never make more than two planes or pitches; all of this will be explained by beginning at Fig. 1, which is a circle enclosed by tangents; at B is seen the square or right angle; at C the obtuse angle; at A the acute angle. These are the only positions required for the construction of any face mould. To illustrate this in the most simple manner, make a square block of any size; let the sides be equal, similar to that seen at Fig. 2; on two of its sides, draw two pitches, in any direction—say 1 2 3; these are of equal length; now, suppose it be required to give the shape that the end of the block will make, if cut through 1 2 3; or, what will be the same thing, cut a piece of board that will exactly fit the sides of the block, in the direction given. The principle on which this is done is seen at Fig. 3; make the square B, to equal the sides of the block, then draw the diagonal line P O indefinite; make O 2 equal O P; take 2 3 or 2 1, Fig. 2, for a radius, and for centres, O and 2, Fig. 3; make intersections at 1 and 3; join 1 2 3 and O 3 1, and we have the section of the block, if cut in the direction of 1 2 3. On the same principle, a board can be cut to fit the sides of the block. To find the bevel, square over 2 D, on the block, then D 1 is the height; make 1 D, Fig. 3, equal to this; join D P: take 1 for centre, and for radius, a tangent curve with D P, cutting at S; join S P, and in the angle is the bevel required. The distance O O, is equal to one side of B; then 1 0 3, are points in the elliptic curve. Before proceeding further, we recommend the pupil to test this problem in a practical way; it can be done at once, either on the work bench or the angle of a room. For example, take any pitch board, place the rise in the angle; then mark the pitch to strike the floor; reverse the pitch board, keeping the rise in the angle; then draw the pitch to strike the ceiling; now take a piece of board, and cut it at once, to fit the two walls in the direction marked; before applying the bevel, cut off the ends of the board square with the lines made for the cuts; remember to reverse the bevel. This illustration will convey more of the true principles of Hand-railing to the mind of the pupil, than all the palaver that has ever been written about cylinders, prismatic solids, normals, and such like humbug.

Our next illustration will be to find the section of the block, if cut in the direction of D 2 3. Observe that 2 D is a square line equal to one side of the block. Then at Fig. 4, draw two lines at right angles to each other, for the major and minor axes; make D O equal 2 3 on the block, and D 2 equal with D 2, and we have the required section. To draw the semi-ellipse, a trammel is preferable to any thing else, but if this is not at hand, a straight edge will answer every purpose. It is presumed that all carpenters are acquainted with the various methods of drawing the oval or ellipse. It will be remembered that the minor axis is ever the same as the given radius of the circle, over which the oval stands; for example O O is the same as O 3, Fig. 1. The given pitch determines the length on the major axis. This will be more clear by drawing two semi-ellipses. On each side of O set off any two equal distances, say V S. The proportion of this on the major axis is found by drawing the line O 2; parallel with this draw V B and S A, then A B is the proportion. We will now strike the inside curve with a straight edge or rod. Set off from its end the distance O V and O B; keep these on both the axes, moving the rod at the same time, and mark any number of points or dots, through which trace the curve. The outside curve is found in the same manner, simply by marking the distance A O and S O on the edge of the rod.

The next problem will be to find the section of the block, if cut by two unequal pitches; also to find the bevels. Let A B C be the cut; at Fig. 5, make 1 2 3 equal two sides of the block; make 3 B C to equal the given pitches; produce C B, cutting F. The section could readily be shown here, but it may be better understood by drawing it at Fig, 6, where the numbers 1 2 3 represent two sides of a square, the same as 1 2 3, Fig. 5. Make 2 F equal 2 F; draw 3 F produced; this is the ordinate. From 1 and 2 draw lines parallel with it; then, through 2 draw 6 K square with the ordinate; make F D equal 1 C, Fig. 5; join D 6; this is the major axis. Make 6 A equal 6 1; make D C equal F 3; join O A and O C; draw C B parallel with O A and A B parallel with O C; this completes the section. To prove it, A B C must equal the given pitches. Find the length of a semi-ellipse that will make A B C its tangents. To do this, take 2 for centre, and 3 for radius; draw the circle to K; from K draw a line parallel with the ordinate, cutting 6 D produced at S. Then S O is one-half of the semi-ellipse. Make O O equal 2 3. Now, if a trammel is set, the elliptic curve will pass through C O A. Two bevels are required. This is a very important affair, from the fact that the accuracy and finish of the rail depend entirely on the proper application of these. Both bevels are found by drawing a line at right angles to any part of the major axis, say D T. Again, from S draw two indefinite lines parallel with C B and B A; take D for centre, and for radius a tangent curve with S V, cutting at X. Join X T, and in the angle is the bevel for the tangent C B. Take centre D, and for radius a tangent curve with S R, cutting at L. Join L T, and in the angle is the bevel for the tangent A B. We wish this method to be well understood, as it is all important to know a pure and correct principle, by which bevels can be found for the joints of hand-rails in all positions. That which has been given is infallible, and employed throughout this work to every wreath piece that is more or less than a quarter-circle. When the wreath piece makes only one quarter of a circle, then the method at Fig. 5 is used, which produces the same bevels as those at Fig. 6. For example, take D for centre, and for radius a tangent curve to the produced line 3 B; draw the circle, cutting at B; join B C, and in the angle is the bevel, the same as that at Fig. 6. Again, take 2 for centre, and for radius a tangent curve to F B, cutting at R; join R 1, and in the angle is the bevel, the same as that in D X T, Fig. 6.

The cuts through a square block and its sections, being sufficiently explained, it only remains to apply the same principle to a piece of stuff, whose sides make the acute and obtuse angles; the same as A and C, Fig. 1. Commence with A; the tangents which enclose this, are 6 7 1; these make the acute angle. We will now suppose this to be a block, and two unequal pitches marked on its sides; then it is required to give the shape or form of it, if cut in the direction of the pitches. To do this, let 1 7 B, Fig. 7, equal the two sides, and B C D the given pitches; produce D C to 8; then make A, Fig. 8, to equal A, Fig. 1; the tangents are the same; make 1 8 to equal 1 8, Fig. 7; draw the line 8 6, indefinitely, and we have the ordinate; draw lines from 7 and 1, parallel with it; through centre O, draw P L, square with P 8; make P R equal 1 D, Fig. 7; join R L; this is the major axis. Then from R N L, draw lines square with it; make R B equal P 6, and N C equal with T 7, and D L equal to L 1; join B C D. These, to be correct, must equal the same letters at Fig. 7. The section of two sides of the block is now given, if cut in the direction named. The other two sides may be obtained by joining N B and N D. To find the bevels, produce C N to V; then draw from R two lines parallel with B C and C D; take N for centre, and for radius, a tangent curve to R J, cutting at F; join F V; and in the angle is the bevel for the tangent B C. Take centre N, and for radius, a tangent curve to R H, cutting at S; join S V, and in the angle is the bevel for C D. Make O O equal O 6; then the elliptic curve will pass through O, and B C D are its tangents. The length of the semi-ellipse is found on the same principle as that at Fig. 6.

Our last problem will be the illustration of the obtuse angle C, Fig, 1; its sides being 3 4 5. These unfold or spread out at Fig. 9. Assume the given pitches to be 7 8 9; produce 9 8 to 6; then let C, Fig. 10, equal C, Fig. 1; make 3 6 equal to 3 6, Fig. 9; draw the line 6 5 indefinitely; this is the ordinate. From 4 and 3 draw lines parallel with it; through centre O draw A H square with A 6; make A B equal 3 9, Fig. 9; join B H; this is the major axis. Draw lines from B N H square with it; make B 7 equal A 5; make N 8 equal T 4, and H 9 equal H 3; join 7 8 9. These, to be correct, must equal the same figures at Fig. 9. To find the bevels, produce 8 N to P; draw B C parallel with 7 8; take N for centre, and for radius, a tangent curve to B C, cutting at V; join V P, and in the angle is the bevel for 7 8. The other bevel find, by drawing a line from N parallel with 8 9; then from any part of the major axis, make a line square with it—say S R; take S for centre, and for radius, a tangent curve, with a line from N; draw the circle, cutting the major axis; join this with R, and in the angle is the bevel for 8 9.

It may be proper to remark, that every face mould and the bevels contained in this work, are found on the same principle as that which has been given on this one plate.

PLATE II

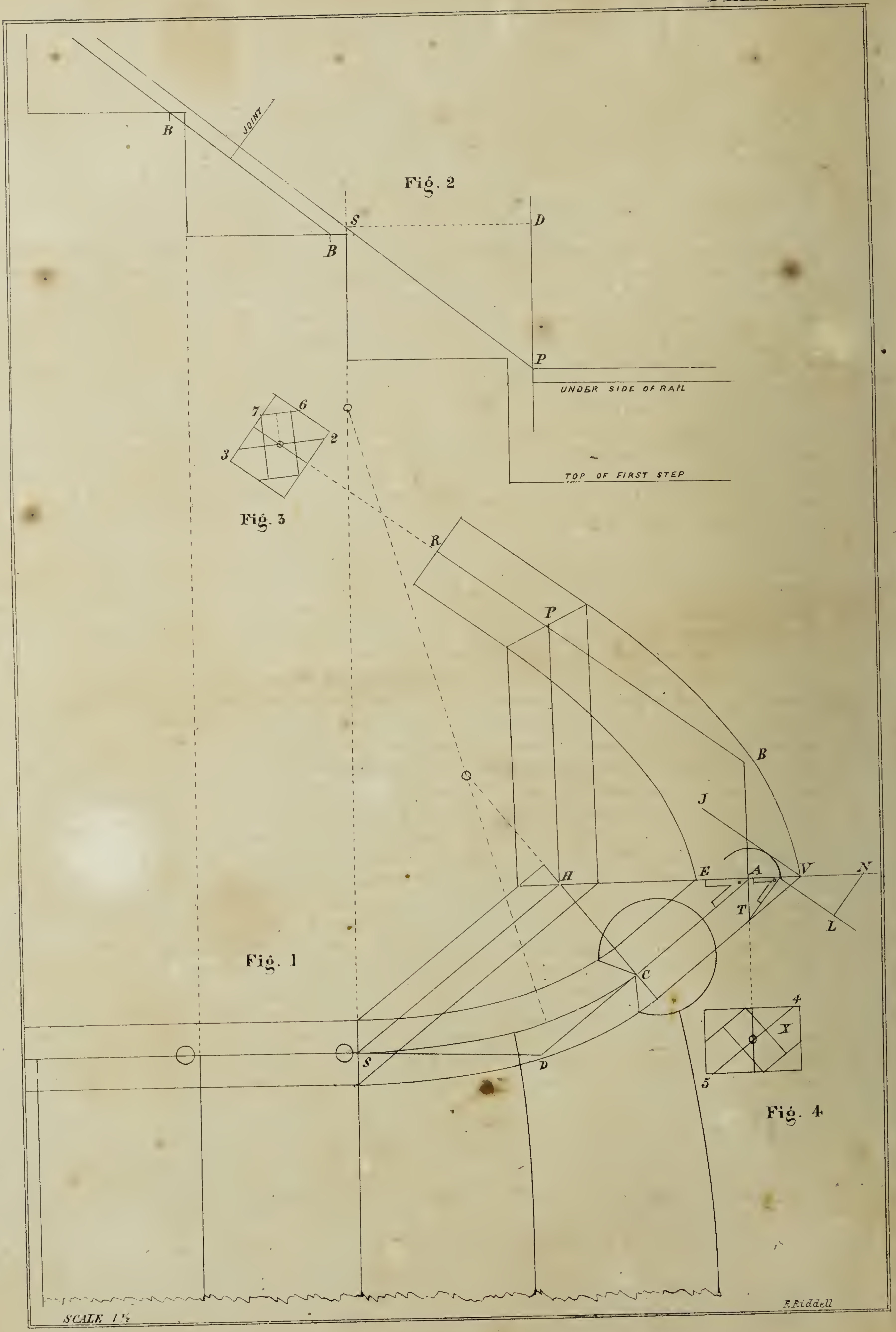


Fig. 2
B
JOINT
S
D
B
P
UNDER SIDE OF RAIL
TOP OF FIRST STEP
7
6
2
3
Fig. 3
R
P
B
J
H
E
A
V
N
T
L
C
Fig. 1
S
P
4
X
5
Fig. 4
SCALE 1½
R.Riddell

PLATE II.

The first practical drawing will be for a wreath, starting from a newel. Scrolls are now but seldom used. The commencement of stairs in all cases should be inviting, and made to present the best possible effect.

This can be readily done by having the ends of the steps curved; also the fronts of the risers, similar to Fig. 1. The face-mould for this wreath is obtained by making the elevation of one or two of the steps seen at Fig. 2. Let the under side of the rail rest on the centre of short balusters B B; set off half its thickness. This draw indefinite. Now determine on the height of the newel; here it is 2 + 9 from the top of the step to the under side of the mitre cap. We are assuming the height of the short balusters to be 2 3. This will make six inches from the top of first step to under of rail. Then the centre of raking and level rail intersect at P, so that D S, Fig. 2, determines the length of the tangent on the ground plan, Fig. 1. This shows that the plan can be made to suit any length of newel. The tangent D C may be drawn to any angle—its length limited by the width of the step; draw the size of the cap, and mark the point of the mitre, say C; then draw any curve at pleasure, so that C and S will be its tangents; on each side of the centre line set off half the width of the rail; in this case D C is the ordinate; draw S H parallel with it; make C H square with C D; make C A equal P D, Fig. 2; join A H produced both ways; then square up lines from A and H; make A B equal C D, and H P equal H S; join B P, produced; this, to be correct, must equal P S, Fig. 2. The mould may be easily traced by drawing a few ordinates. Find the bevel for the joint on the straight wood, by drawing V J parallel with B P. Take A for centre, and for radius a tangent curve to V J, cutting at A; join this with T, and in the angle is the bevel required. This being for the end of the joint, it is very evident we can find the width of this or any other mould by the bevels. For example, draw A L square with the bevel; on this set off the width of the rail to L; draw L N parallel with A T; then N A is the width of the mould at R; the bevel for the lower part of the wreath is in the angle A C H. Now prepare the mould with neatness and accuracy; make the joint R square with R P, and the joint V E square with A B; square over A and R on the edge of the mould, and mark the tangent R B on the other side. The stuff being cut square through and one side faced truly, lay the mould on, and mark the joints and tangents on the face of the plank, the same as they are on the mould; a guide is thus given to make the joints true, (not depending on the lines made by the end of the mould;) now set the bevels, with which mark both joints through the centre of the plank, indicated by O O, at Figs. 3 and 4; then 4 5, Fig. 4, is the point of the mitre; on each side of the centre lines through O, set off half the width of the rail; lay the mould on the stuff; make A fall on 4, and the line P R fall on 2; mark the plank by the edges of the mould. The application for the other side. Make A fall on 5, and P R on 3; mark the plank from the edges of the mould; observe that Fig. 3 is the joint on the straight part, and 6 7 the outside slab; this cut off; work it to the line, and square with the end of the joint. The dotted line from centre O, this square down the side; mark on it from the end of joint, a distance to equal P R, through which mark the plumb line by the rise of the pitch-board. This is a direction to take off the extra wood; also, a direction to measure for the length of the straight rail, that connects with this wreath; at Fig. 4, notice that X is the slab on the under side of the wreath; this cut off at right angles with the joint, work it down to the line, and square with O 5; lay off the mitre the same as at C; cut off the slabs, and make the mitre square with the under side; the wreath is now taken to a thickness. We wish to be understood that the joints in all cases are made first and square with the face of the plank, and that slide lines are entirely discarded from every part of this work; a better and more correct principle is given.

PLATE III.

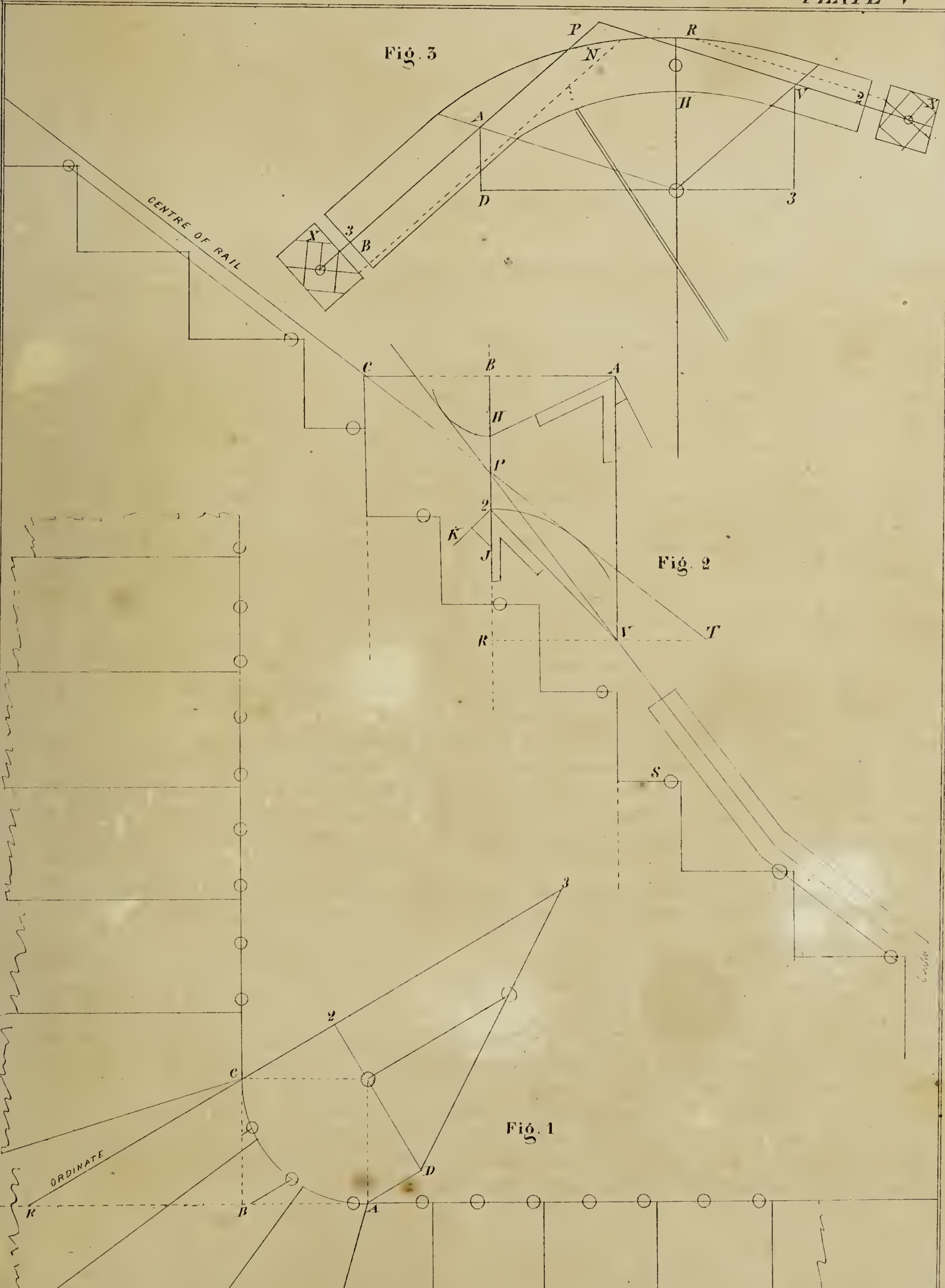
Fig. 1 exhibits the landing of a staircase, the plan of which is an obtuse angle. It is required to give the position of the last riser-landing, in order that the wreath may be in one piece, its upper part to fall level on the landing, and to a given height.

First determine the position of the riser, by making the elevation of one step, seen at Fig. 2; draw the landing line D C; set up the given height for the centre of level rail—say A B; draw the under side of raking rail to rest on the centre of short balusters; set off half its thickness; this draw until it cuts A B; from the intersection square down a line to D; then make D S, at **A**, equal D S, Fig. 2, and the position of the riser is given. To draw the face mould, make 4 3 V parallel with D R; make centre o and R square with 3 4; make 3 V equal 3 A, Fig. 2; join R V, produced; make R 6 and V 4 square with V R; make R 6 equal R D, and V 4 equal 3, 4; join 4 6, and we have the tangents that stand over those on the plan **A**. Let **B** be a piece of board for the mould; make N V R equal N V R, Fig. 1; notice that V R and 6 4 are the same as those at Fig. 1; produce 6 4 and 6 R for the straight wood; the width of the mould at P is found in **A**; make R 2 equal half the width of the rail; square over 2 S; then R S is half the width of the mould; this set off on each side of P; the bevel for the joint is in the angle V 3 R. Find the width of the mould at X, also the bevel for the joint, by drawing the line N T parallel with 4 6, Fig. 1; take V for centre, and for radius, a tangent curve to N T, cutting A; join A P, and in the angle is the bevel. To obtain half the width of the mould, draw a line from A square with A P; on this set off half the width of the rail; this draw parallel with A P, cutting A N, which gives half the width of the mould; on each side of X, draw the straight wood parallel with X 4 and P R; now strike the mould with either a trammel or straight edge.

Suppose the position of the riser given, or that its face be on the line 4 O, and that it is required to find the face mould for a wreath that shall make the same height on the landing as that which has been stated. In order to avoid confusion, let Fig. 3 be the same as **A**, and the face of the riser A B, as proposed; from centre of short baluster, draw the under side of the rail with the pitch board; set off half its thickness; make A B the same height as that on the landing, Fig. 2; from B square over a line to cut centre of rail at C; then B C determine the length of level tangents A 2 3.

To draw the face mould. At C make N A 2 3 equal the same letters and numbers as Fig. 3; from A and N draw lines parallel with 2 3; make P R equal A B, Fig. 3; join R 3, produced both ways. This line is the major axis, and H its centre. Square over the lines 3 R H; make 3 O equal 3 2, and R J equal P A; join O R, produced to W; find the width of the mould at 3, by setting off half the width of the rail on 3 P; this square up to cut 3 R, which is half the width of the mould; the bevel for this joint is in the angle R P 3. To find the bevel for the joint at W, and the width of the mould. From any part of the major axis, say T, make T V square with T H; draw H X parallel with J O; make T a centre, and for radius, a tangent curve with H X, cutting at K; join K V, and in the angle is the bevel. Draw K S square with K V; on this set off half the width of the rail; then square down to cut the major axis, which gives half the width of the mould; this set off on each side of W; draw the straight wood parallel to W J; now strike the mould; observe that its tangents prove correct; for example, the line 3 O being the same length as 2 3 on the plan, Fig. 3; of course this falls level on the landing, and the line O J being on the rake, must equal A C on the plan. The jointing and application of the bevels are precisely the same as that which has been stated on plate 2.

PLATE V



SCALE 1 Inch

R Riddell

PLATE IV.

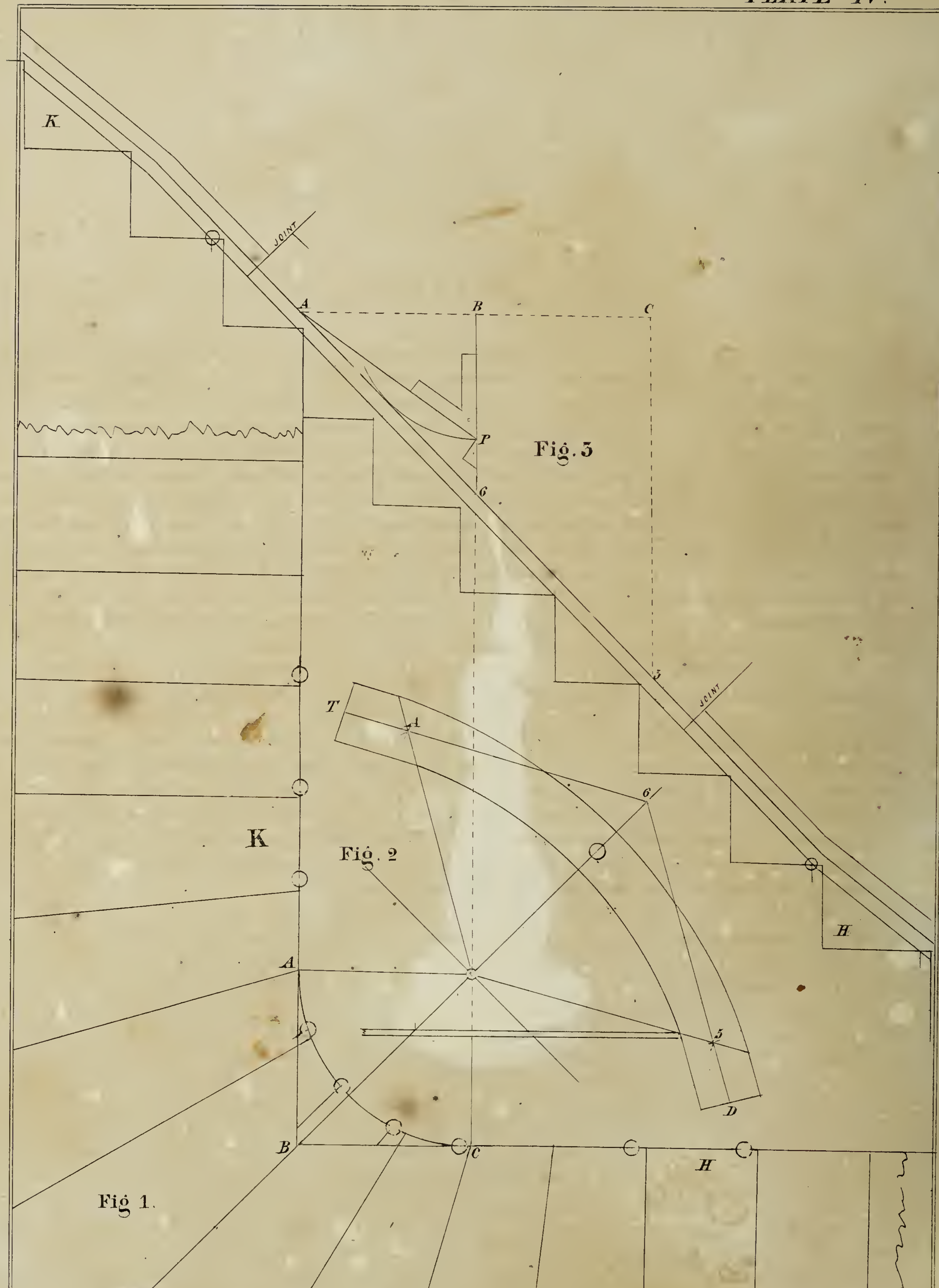

K
JOINT
A
B
C
P
Fig. 3
6
5
JOINT
H
T
4
6
K
Fig. 2
A
5
D
B
C
H
Fig 1.
SCALE 1 Inch
R. Riddell

PLATE IV.

Fig. 1 exhibits the plan of a staircase, with a quarter-circle, containing winders in both the circular and straight parts; centre line of the rail given. Its tangents are A B C. To find the face mould for this is a very simple affair, from the fact that the diagonal line B O, is the ordinate. Such being the case, the length of the balusters in the circle can be given with the greatest accuracy, simply by drawing a line from the centre of each baluster to cut the tangents; these are drawn parallel with B O; now unfold the tangents A B C, in the same manner as laying out a string; if a board is not at hand to do this, the bench will answer every purpose, and the framing-square will be found more convenient than either a pitch-board or bevel, for laying out the work. For example, take a strip and make a slit in each end; put this on the tongues of the square, for a fence; Fig. 3 shows the elevation of the winders, also the centre of the balusters, transferred from the tangents A B C, Fig. 1; mark the centre of short balusters on the square steps H K, Fig. 3; let the under side of rail on the common pitch rest on these; set off half its thickness; draw the centre of the rail over the winders; where this intersects the centre of rail on the common pitch, form the ramps. The under side of the rail being drawn, show that the balusters are all one length, with the exception of two.

To draw the face mould, make O 6 equal O B, (Fig. 2;) then at Fig. 3 take 6 A or 6 5 for a radius, and O 6 for centres, (Fig. 2;) make intersections at A and 5; draw lines from 6 and O through the intersections; make O O equal O A; on each side of O set off half the width of the rail. To find the width of the mould on the straight part, and the bevel for the joints. This is obtained at Fig. 3; take B for centre, and for radius, a tangent curve with A 6 cutting at P; join P A, and in the angle is the bevel;* then from P draw a line square with P A; on this set off half the width of the rail; this draw parallel with P A, cutting P 6; then P 6 is half the width of the mould; which set off on each side of T and D; draw the straight wood parallel with T A and D 5; now strike the mould; make its joints square with the tangents. The ramps that connect with this wreath or any other,—great care should be taken to have the joints perfectly true, in order to avoid a strain, and other defects, which undoubtedly will be the case, if this is not attended to.

---

* Remember, when the tangents are equal in length, as in this case, one bevel answers for both joints.

PLATE V.

The difference in the plan of this staircase, and that on plate IV, is the arrangement of the winders, which, perhaps, is preferable, on account of its simplicity. Another advantage is, that the upper part of the wreath makes its own ramp; taken altogether, it will be found to cost less in the execution, and when finished, will present a beautiful appearance.

Fig. 1 is the ground plan. The centre line of rail given; its tangents are A B C; these unfold or spread out on a board, the same as laying out a string, seen at Fig. 2. The elevation of the winders is the same as those on the plan; that is, their measurements are taken from the tangent lines A B C, but do not understand that these measurements give their true position. On the elevation, this cannot be done until the ordinate is obtained, yet they give a sufficient guide to draw the pitches, but in this case the pitches are determined, as will be presently seen, by laying off one or two of the square steps on the upper and lower parts of the elevation. Then make the under side of the rail on the common pitch to rest on the centre of short balusters; set off half its thickness; this draw indefinitely. We now see that the upper pitch having cut through P, determines a point to draw the lower pitch, the winder S, being the exact elevation of winder A on the plan. The rail here is raised, but, if desired, can be made to rest on the baluster S, still retaining P as a pivot, on which it swings, so to speak. The elevation being finished, find the bevels for the lower and upper joints of the wreath. That for its upper part is obtained by drawing a line through V, cutting T R; take R for centre, and for radius a tangent curve with P T cutting at 2; join 2 V, and in the angle is the bevel for the upper pitch. That for the joint on the lower pitch. Take B for centre, and for radius a tangent curve with V P produced; draw the circle, cutting at H; join H A, and in the angle is the bevel. The position of the balusters on the tangents of plan can now be given, by making R B equal R T, Fig. 2; draw R C indefinitely. This is the ordinate. Draw lines from A and centre O, parallel with it; through O make 2 D square with the ordinate; make 2 3 equal V A, Fig. 2; join 3 D. This is the major axis. Observe that the lines from the centre of balusters cut the tangents parallel with the ordinate. Their position on the tangents are transferred to the elevation, seen at Fig. 2, so that if the under side of the rail is drawn, we have the exact length of the balusters in the circle. To draw the face mould, let Fig. 3 be a piece of board for this; on its edge, make D O 3 equal D O 3, Fig. 1; make 3 V equal 2 C, Fig. 1, and D A equal A D, Fig. 1; join O V and O A; draw V P produced, parallel with O A; draw P A produced, parallel with V O. Now find the width of the mould on the straight parts. This is obtained from the bevels, and for this reason; the section of the rail being marked on the joints by the bevels. These lines having cut the surface of the plank, at once give the width of the mould. Then one side of the angle, in which the bevel is, may be considered the face of the plank, so that by drawing half the width of the rail, parallel with the other side of the angle, cutting the first named, we have half the width of the mould. To illustrate this, at Fig. 2, draw 2 K square with 2 V; make 2 K equal to half the width of the rail; draw K J parallel with 2 V. Then 2 J is half the width of the mould, because 2 J is the surface of the plank, and 2 V may be considered the end of the joint. This set off on each side of 3, Fig. 3; draw the straight wood parallel with 3 A. If we may be allowed to use the word square over square, up or down, it will shorten the description and convey the same meaning as right angle, parallel, &c. For example, square out a line from the angle of the bevel A; on this set off half the width of the rail; then square down a line to cut A V. This is half the width of the mould, which set off on each side of 2; draw the straight wood parallel with V P, Fig. 3; O O being the minor axis, and is in all cases equal to the given radius on the plan. On each side of O set off half the width of the rail. Now strike the mould and dress it truly to the lines; make the joints square with the tangents; these square over its edge and ends; mark the tangents on the under side of the mould. The plank being cut square through, face one side; lay the mould on, and mark the joints; but before moving it, mark the position of the tangents on the stuff the same as those on the mould, also the line R H. A proper guide is thus given to make the joints on the wreath, not depending on the lines made by

PLATE V

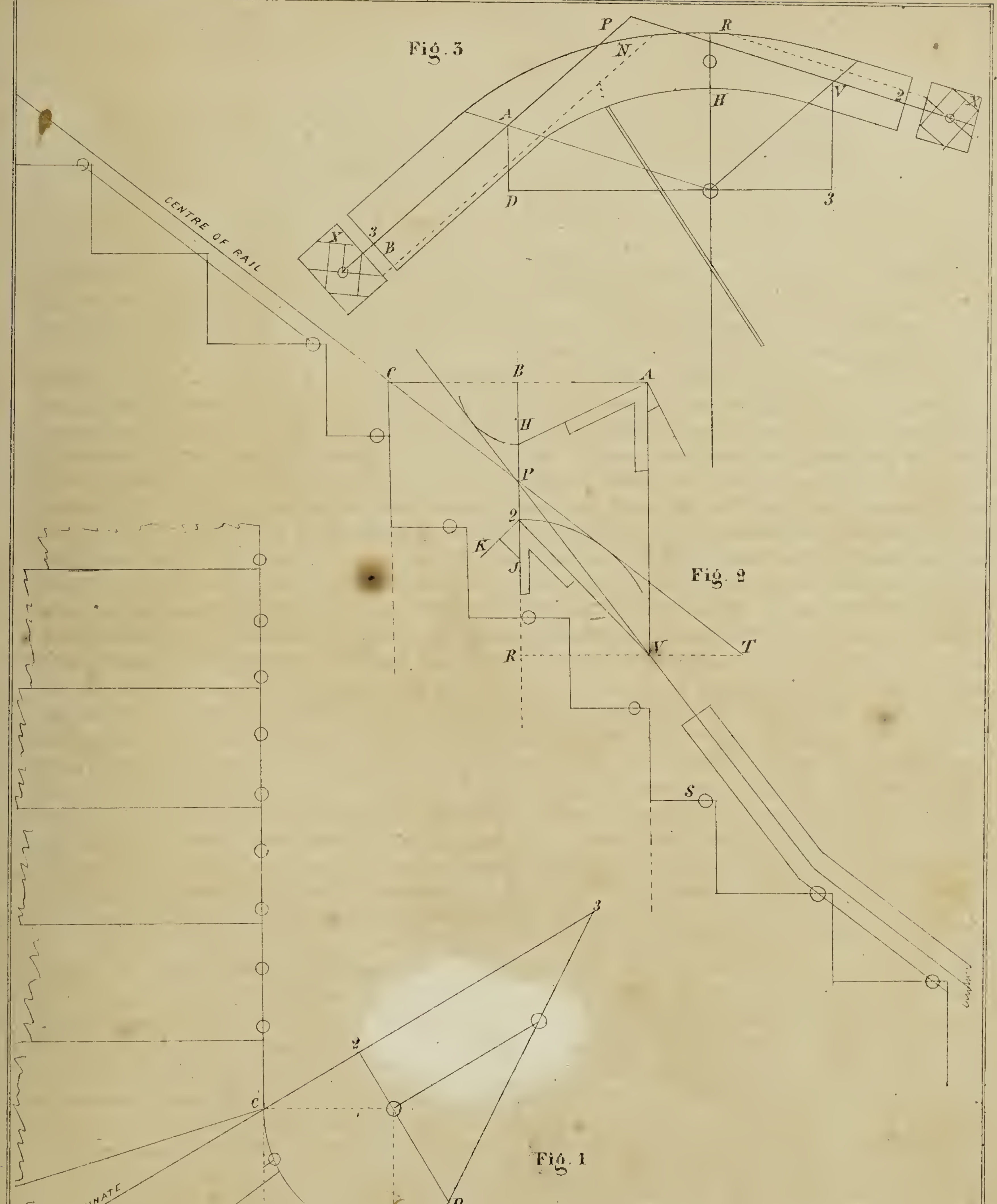


Fig. 3
P
R
N
H
V
2
X
A
D
3
X
3
B
CENTRE OF RAIL
C
B
A
H
P
2
K
J
Fig. 2
R
V
T
S
3
2
C
Fig. 1
D
ORDINATE
R
B
A
SCALE 1 Inch
R Riddell

the ends of the mould. Remember that it has been stated that the accuracy of the work depends entirely on the joints. There can be no difficulty in this, if the square is properly applied. For example, place the stock of the square on the joint; make the blade agree with the line on the surface; for the other direction keep the stock against the joint, and make the surface of the plank and the blade agree. The next thing will be to set the bevels truly; have the blade in the centre of the stock; now mark the square section of the rail on each joint, and in the centre of the plank O O. The sections show that the bevels are reverse to each other.* This is mentioned in order that there may be no mistake in their application. The centre lines through O O on the joints; mark these on the surface of the plank, indicated by the dotted lines B N and 2 R. The lines are marked on the under side of the plank the same as on the top. The bevel through centres O O, gives the direction. Now the application of the mould is perfectly simple; no slide lines or any such nonsense wanted. It is simply to make the tangents on the mould fall on those made on the stuff; that is to say, 3 P and B N are made to agree; also make P V and 2 R agree. Then mark by the edges of the mould. The application on the other side of the plank is the same as that for the top side. Now cut off the slabs marked X X; work each end down to the lines, and square with the joints the lines O X; these square down the sides, on which mark the distance 3 A and 2 V. Then mark the plumb lines, that for 3 A the pitch-board gives: the pitch for 2 V is the angle P R V, Fig. 2. A direction is now given to hold the plane or saw for taking off the extra wood. This being done, square over R H on each edge of the plank; mark its centre; on each side of this, set off half the thickness of the rail, the same as the sections. We have now its thickness in three places; that is, on both ends and the centre, and all that is required, is to cut off the slabs in the direction thus obtained. The thickness of the rail being in the centre of the plank, shows that falling moulds are unmeaning and absurd. The plank itself forms the most graceful and natural curves that can be desired, provided that no uncouth savage hacks with a broad-axe.

---

* This is the case with every wreath, except that starting from a newel.

PLATE VI.

Fig. 1 is the plan of a staircase, with quarter-landing; the centre line of rail given; the risers in a position that the wreath can be obtained in one piece, having the shanks or straight wood on the same pitch as the stairs; the quarter-circle not limited to any particular radius; the tangents intersect at A; on each side of this set off half a step, then set off the other risers; place the point of the pitch-board at A; draw the pitch; also draw the diagonal line O A. This is the ordinate. Find the bevel by taking 3 for centre, and for radius, a tangent curve, with C 2 A cutting H; join H A, and in the angle is the bevel. This answers for both joints of the wreath. Let Fig. 2 be a piece of board for the mould; the square line O A make equal with O A, Fig. 1; take A D for radius, and O A, Fig. 2, for centres; make intersections at 2 2; from A and O draw lines through these; then make O O equal O O, Fig. 1; on each side of O set off half the width of the rail. Find the width of the mould on the straight parts. This is given by the bevel at Fig. 1, by making a line square with H A; on this set off half the width of the rail; then square down to V, and V H is half the width of the mould. This set off on each side of S S, Fig. 2; draw the straight wood parallel with A S; make the joints square with the tangents; then strike the mould; dress it to the lines; mark the plank and cut it square through; face one side; apply the bevel to the joints. On the principle which has been given, the tangents on the mould are made to fall on E E and e c, which have been marked on the plank. Now mark the stuff by the edges of the mould; cut off the slabs X X; the line O X square down the sides; on these set off the distance S 2; mark the plumb lines with the pitch-board; take off the extra wood in the direction of the plumb lines; this being done, square over the line O O on both edges; on these mark half the thickness of the plank, on each side of which, set off half the thickness of the rail. This being marked on each joint, and in the centre of the piece, a plain direction is given to square the wreath.

We will now suppose the position of the risers changed, or that their faces be on a line with O 3. In such a case, the wreath must be in two pieces. To illustrate this, a separate drawing is made at Fig. 3, which is the same as Fig. 1, with the exception of the risers, they being placed in the position named. Observe that the joint is made at 4, and the tangent drawn at a right angle to it. This makes four tangents of equal length, indicated by 2 3 4 5 6; these unfold, (seen at Fig. 4;) then make the elevation of a step and riser, at the lower and upper ends. From the joint square out a line; then draw the pitches, cutting R and S; make 4 B, Fig. 3, equal S T, Fig. 4; draw B 6 indefinite. This is the ordinate. Draw lines from 4 5 parallel with it; make centre O and V square with V B; make V T equal 6 T, Fig. 4; join T B; draw O X parallel with T B. This is the major axis. Make X H equal V 6; make K L equal S 5, and J P equal B 4; join H L and L P produced. These, to be correct, must equal the pitches at Fig. 4. To find the bevels, produce P J, cutting A; draw K W parallel with H L, and K J parallel with L P. Take J for centre, and for radius, a tangent curve with J K cutting I; join I A, and in the angle is the bevel for the joint S. That for the joint H. Take centre J, and for radius, a tangent curve, with K W cutting at N; join N A, and in the angle is the bevel required. The width of the mould is obtained from these bevels. The principle to do this has been given. Set the trammel, or straight edge, and strike the mould; the joints make square with the tangents; the application of the bevels and mould has been given. Remember, that when the two pieces of wreath are put together, the centre lines on the joints must be opposite, in order that the shanks may be on the proper pitches.

PLATE VI

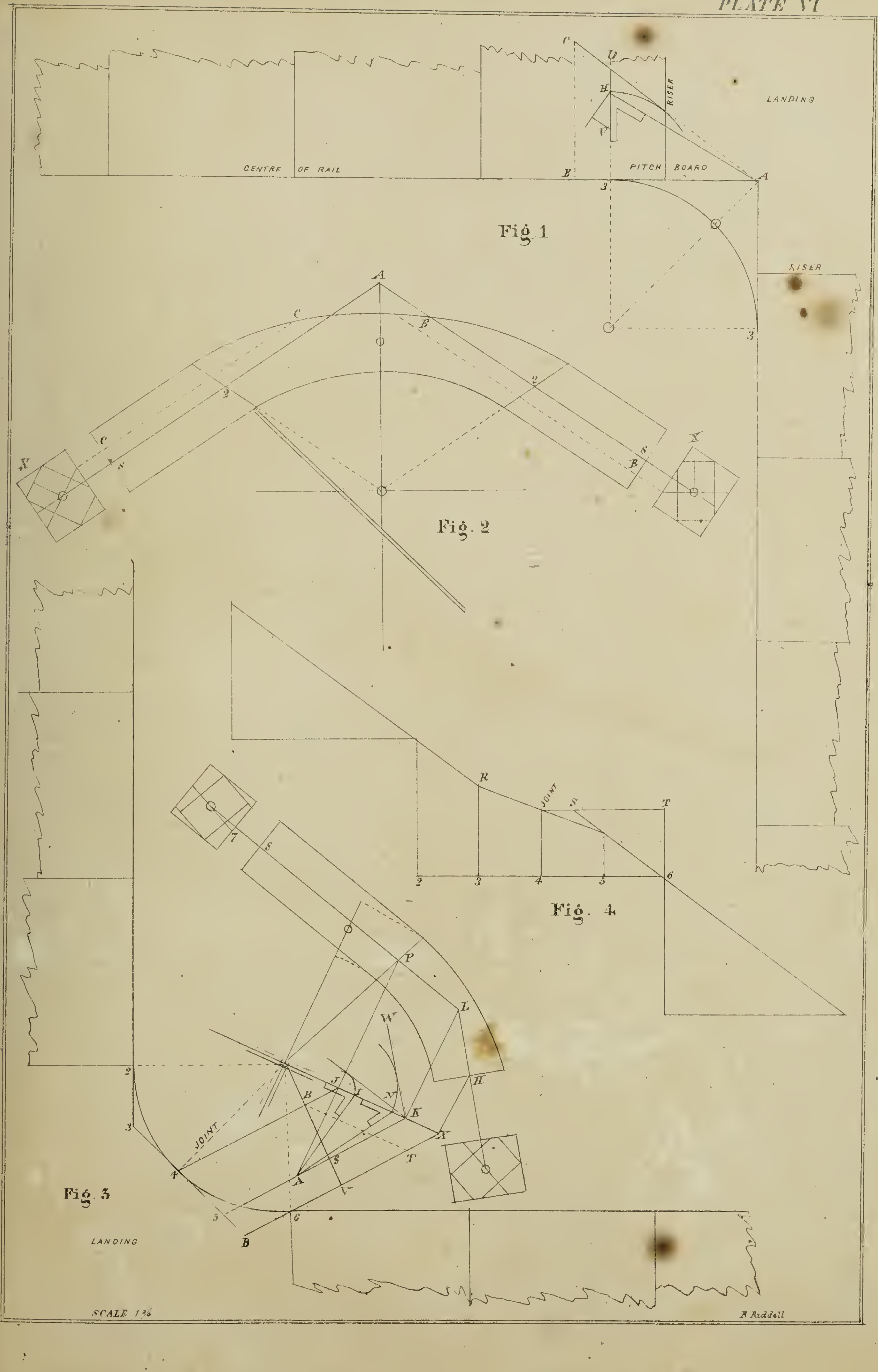


Fig. 1

Fig. 2

Fig. 3

Fig. 4

PLATE VII.

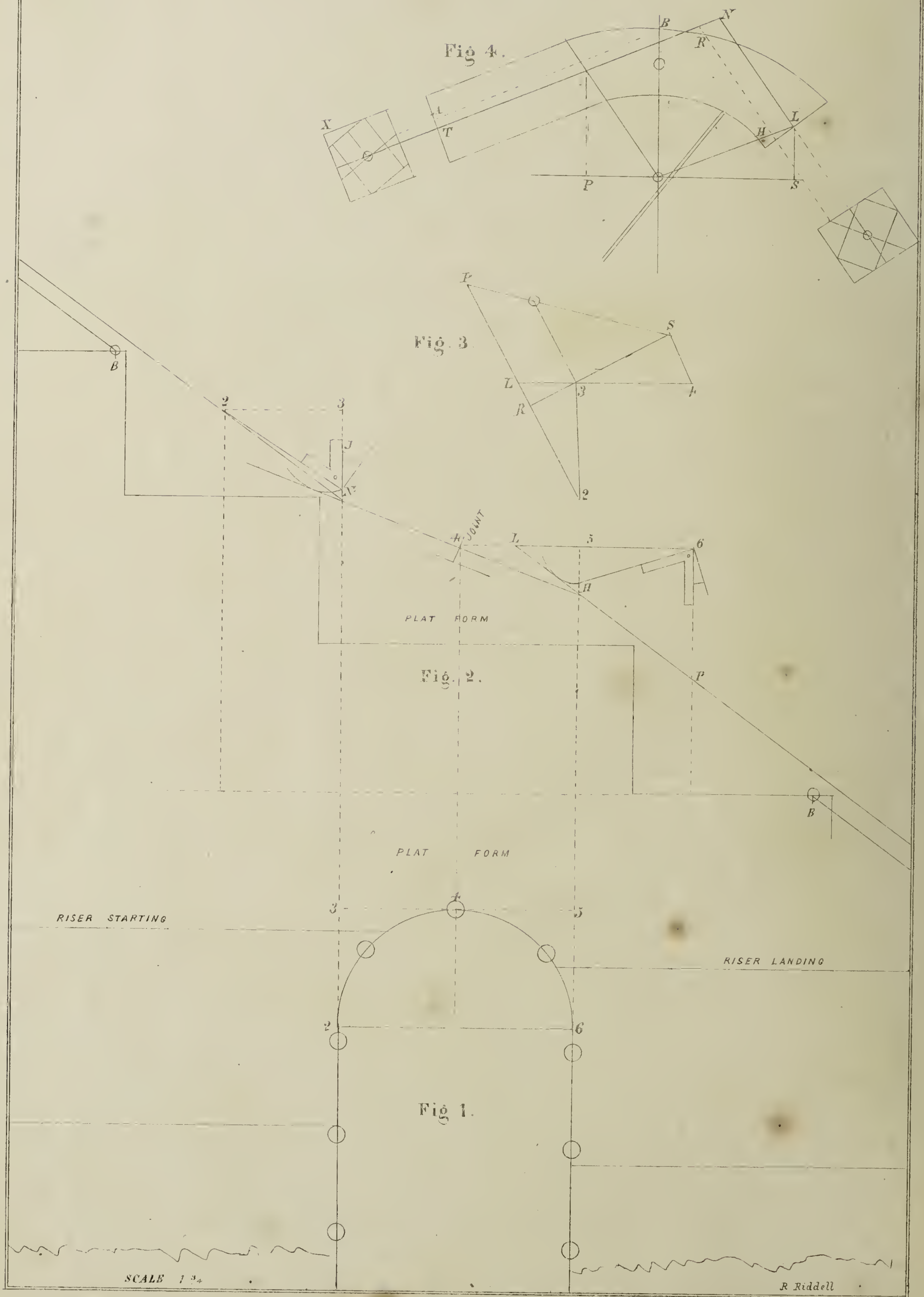


Fig 4.

Fig. 3

Fig. 2.

Fig 1.

SCALE 1 ¾

R Riddell

PLATE VII.

Fig. 1 is the ground plan for a platform staircase; the balusters here regulate the position of the risers, that is to say, the space between them is equal to half a step on the centre line of the rail.

Commence at centre 4, and lay off the balusters; two of these being on the platform, at once determine the position of the risers; the tangents which enclose Fig. 1, these unfold at Fig. 2; then make the elevation of the platform and the two steps the same as on the plan. Let the under side of straight rail rest on the short baluster B B; set off half its thickness; this draw indefinite, cutting through H, and at N; join H N; from the centre of joint 4, square over a line cutting 6.

To draw the face mould, make two sides of a square at Fig. 3, to equal 2 3 4 on the plan; make 4 L equal 6 L on the elevation; from 2 draw a line through L, indefinite; this is the ordinate. Draw from 3 and 4, lines parallel with it; square over R S, cutting the angle 3; make R P equal 6 P on the elevation; join P S, and we have the major axis. Let Fig. 4 be a piece of board for the mould; mark on its edge P O S, the same as at Fig. 3; square the lines over, and make S L equal S 4, Fig. 3; make P 2 equal R 2; join O 2 and O L; make L N parallel with O 2, and 2 N parallel with O L. Extend the line from 2, for the straight wood, which may be any length. The tangents on the mould, to be correct, must equal the pitches on the elevation, that is to say, 2 N L equal 2 N 4, Fig. 2. The width of mould at the joints L and T, are obtained from the bevels. These are found on the elevation. That for the joint L, take 3 for centre, and for radius a tangent curve with the produced line 4 N; draw the circle, cutting at N; join N 2, and in the angle is the bevel required. From N, make a line square with N 2; on this set off half the width of the rail, from which, square down to cut J; then N J is half the width of the mould; this set off on each side of L, Fig. 4; the bevel for the joint T is found at Fig. 2. Take 5 for centre, and for radius a tangent curve with H L cutting at H; join H 6, and in the angle is the bevel. From 6, make a line square with 6 H; on this set off half the width of the rail; this square down to cut P 6, which gives half the width of the mould; this set off on each side of T, Fig. 4; the straight wood draw parallel with T 2, the minor axis being O O, and equal to O O on the plan. Then, on each side of O, set off half the width of the rail; make the joints square with the tangents. Now, with either trammel or straight-edge, strike the mould; make the joints square with the tangents. The application of the mould, and the method to square the wreath, have been stated; but this description of stairs being frequently required in both town and country, may attract the attention of the pupil more than some other plans, so that repetition will do no harm.

Cut the stuff square through; face one side; square the tangents over the edge and ends of the mould; mark these on the other side. Now, lay the mould on the stuff, and mark the joints; but before moving it, mark from the edge and ends, the direction of the tangents; these mark on the stuff, (not with a pencil,) the same as on the mould; make the joints square with these, (not depending on the line made for the joint;) also square with the face of the plank. Remember, that the accuracy of the work depends entirely on the joints being truly made, and the bevels properly applied; if attention is given to this, there is no more difficulty in producing a wreath than any other piece of work in carpentry.

The joints being made, mark the centre of the plank the same as O, on the square section; now set the bevels, (the blade in the centre of stock,) and mark through o, the centre of each joint; on each side of which set off half the thickness, and half the width of the rail, the same as on the square sections. The lines through the centre of joints O, square these over the face of the stuff, indicated by A B and H R; also, square them over on the under side, in the direction of the centre line through O. Now lay the mould on the piece, and make L N fall on H R, and N T fall on A B; mark by the edges of the mould; on the other side make the lines on the mould fall over those on the stuff, and mark by the edges. Cut off X, the outside slab on the shank; work this down to the bevel line, and square with the joint. The line from centre O to X, this square down the side, and mark from the end of joint, the distance T 2. Now take the pitch-board and mark the spring line, that is to say, where the circle ends. A direction is thus given to take off the extra wood. The plane or saw keep parallel with the line made by the pitch-board. The piece is now supposed to be worked to the lines made by the mould. Square over B C, the minor axis, that is to say, on the sides of the piece; now mark the centre of the plank, on each side of which, set off half the thickness of the rail. We have now the thickness of the rail on each joint, and in the centre, through which cut off the slabs. When the two pieces which form the wreath are connected, remember to have the centre lines on each joint opposite.

PLATE VIII.

Fig. 1 exhibits the ground plan of a platform staircase, with a large cylinder; the wreath made in three pieces. Every wreath should be in three pieces, when the cylinder exceeds twenty inches.

It will be noticed on the plan, that the balusters are opposite. The position of the risers, landing and starting, are such as is thought best for the appearance of both stairs and rail; however, these may be varied to suit the judgment of the workman or other circumstances. The tangents which enclose the circle, are seen unfolded at Fig. 2; this being the elevation of the steps and platform, the same as on the plan. Let the under side of the straight rail rest on the centre of short baluster B B; set off half its thickness; this draw indefinite, cutting through H and N; join H N. We have now the pitches, also the centre of rail and plank on the elevation. Two face moulds will be required; one mould answers for the two pieces which connect with the centre piece, and is obtained by drawing a line from V to 6, square with 6 E. At Fig. 3, make P S J X equal 4 5 6 X on the plan; make P R equal L 6, Fig. 2; from R draw a line through J, indefinite, which gives the ordinate. From S and P draw lines parallel with this; from centre X draw a line to N, square with X P; make N H equal 6 E, Fig. 2; join H X, and we have the major axis. From H 3 X square over the lines; make H T equal J R, and 3 W equal K S, and X V equal X P; join T W and W V; this line extend.

Before drawing the mould, find the bevels; these are obtained by producing the line W 3, cutting at N. Now draw from H two lines parallel with T W and W V; take 3 for centre, and for radius, a tangent curve, with H 4 cutting at 2; join 2 N, and in the angle is the bevel for joint T. That for the shank is found from centre 3, and for radius a tangent curve with H C cutting at 3; join 3 N, and in the angle is the bevel for D. Find the width of the mould, as usual; draw the straight wood parallel with D V; make O O equal the radius on the plan; on each side of O, set off half the width of the rail; make the joints square with the tangents; now strike the mould. The jointing and application of the mould have been stated.

The mould for the centre piece of wreath is found at Fig. 4, by making the line O S A equal X S 5, Fig. 1. Through S, draw B C square with S O; make A B and A C equal to V K, Fig. 2; make A V equal to 4 5, Fig. 1. Find the bevel by taking O for centre, and for radius a tangent curve cutting at R; join R O, and in the angle is the bevel for both joints of this piece of wreath. Make O O equal to the radius on the plan; on each side of O, set off half the width of the rail; the compasses will strike this mould sufficently near; make the joints square with the tangents.

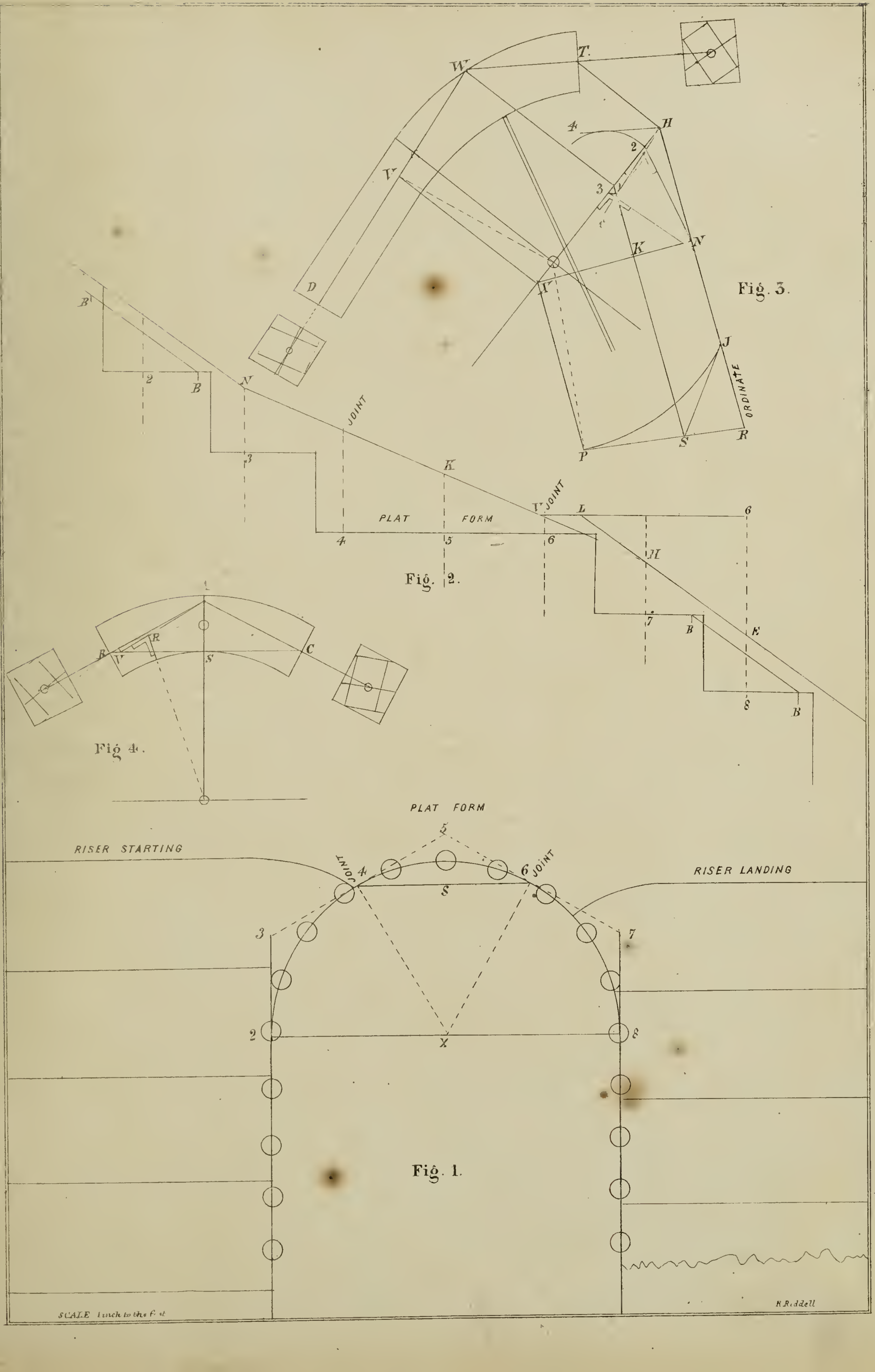


Fig. 3.

Fig. 2.

Fig 4.

Fig. 1.

PLATE IX

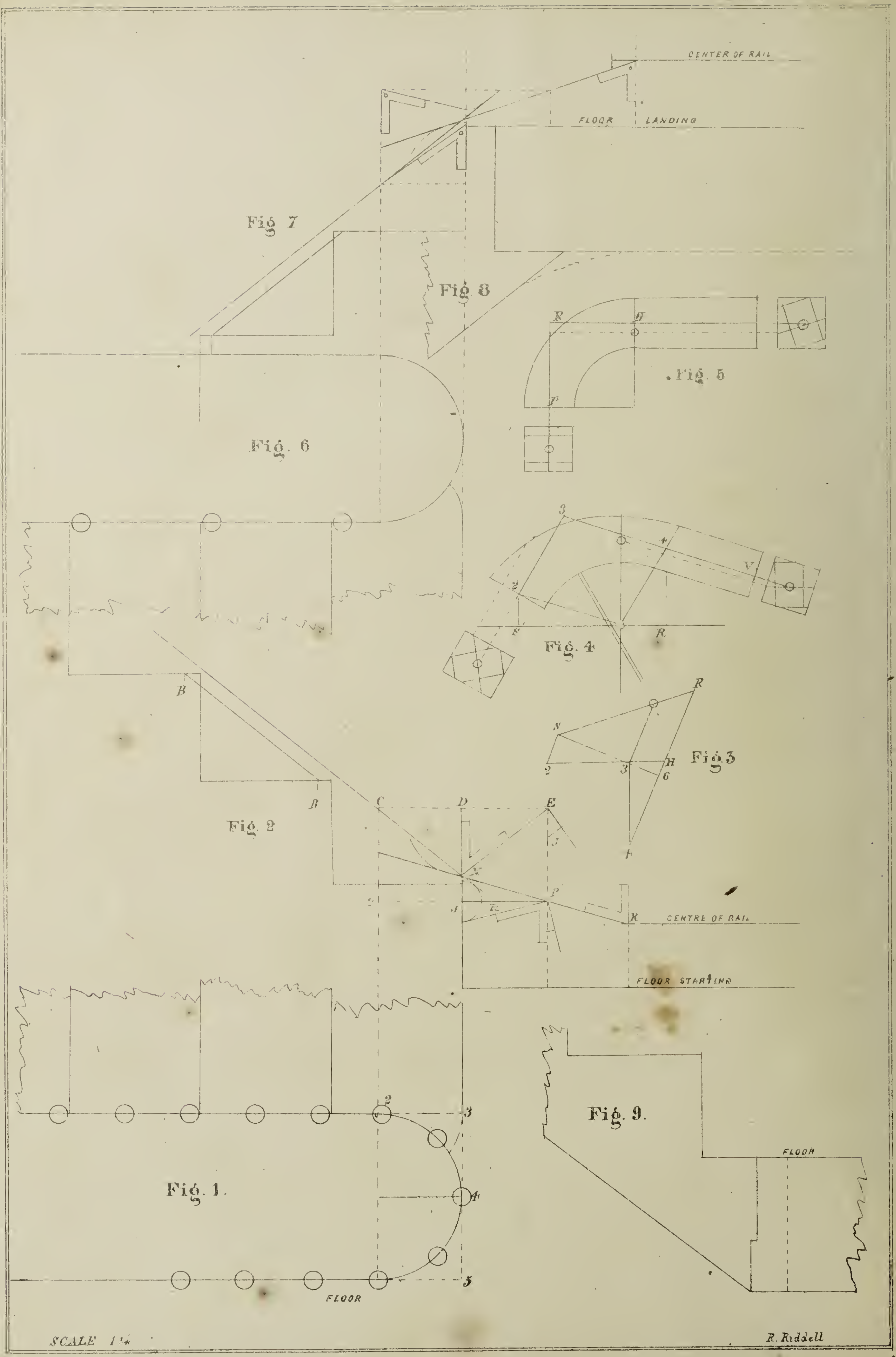

CENTER OF RAIL
FLOOR LANDING
Fig 7
Fig 8
F
H
F
Fig. 5
Fig. 6
3
2
4
V
S
R
Fig. 4
R
N
2
3
H
6
4
Fig 3
B
B
C
D
E
J
K
P
J
K
K
CENTRE OF RAIL
FLOOR STARTING
Fig. 2
Fig. 9.
FLOOR
2
3
4
5
Fig. 1.
FLOOR
SCALE 1¼
R. Riddell

PLATE IX.

The intention of this plate is to show the proper construction of a straight flight of stairs, having a cylinder landing and starting. This may seem a very common affair, to some extent, it is so, owing to the awkward and careless manner of many workmen who are under the impression that the risers should be placed in the cylinder, so that the wreath (or rather a crooked stick) may fall level at the centre joint. In our opinion, this produces a most wretched appearance. The plan laid down is to avoid these defects and give the job the appearance of a finish. The wreath at either landing or starting, should present to the eye graceful flowing curves, in fact the plank almost speaks and insists upon producing the line of beauty. This may be noticed by any person who will give the subject the least consideration.

The attention of the pupil will be now directed to Fig. 1, which is the ground-plan starting, the face of the first riser being on a line with the centre of the rail. The tangents which enclose the circle, are unfolded at Fig. 2; draw the floor starting; then make the elevation of one or two steps the same as on the plan; set off above the floor, centre of level rail; let the under side of raking rail rest on centre of short balusters B B; set off half its thickness; this draw indefinite, cutting C and X; notice that the centre of level rail stops at R, which represents 5 on the plan; join R X. This completes the elevation of the pitches. The face mould is now obtained, and for this square over C D E; also square over P H 2. At Fig. 3, make 2 3 4 equal 2 3 4 on the plan; make 2 H equal H 2, Fig. 2; from 4 draw a line through H indefinite. This being the ordinate. Draw lines from 3 2 parallel with it; draw 6 S through 3, and square with 6 4; make 6 R equal E P, Fig. 2; join R S. The major axis. Let Fig. 4 be a piece of board for the mould; mark on its edge S O R the same as S O R, Fig. 3; square over the lines; make R 4 equal 6 4, Fig. 3; make S 2 equal S 2; join O 2 and O 4; draw 2 3 parallel with O 4; draw 3 4 extended, parallel with O 2; this completes the tangents on the mould. These, to be correct, 2 3 4 must equal C X P, Fig. 2. To find the width of the mould, produce the bevels; that for the joint 2, take D, Fig. 2, for centre, and for radius a tangent curve with P X produced; draw the circle cutting at X; join X E, and in the angle is the bevel. From E square out a line; on this set off half the width of rail, from which square over to cut at J; then E J is half the width of mould, which set off from each side of joint 2. The bevel for the joint V. Take J, Fig. 2, for centre, and for radius a tangent curve with the produced line C X; draw the circle cutting below J, from which draw to P; and in the angle is the bevel. From P draw a line square with it; on this set off half the width of rail; square this over, which gives half the width of the mould; this set off on each side of V, Fig. 4; draw the straight wood parallel with V 4; make O O equal to the radius on the plan; on each side of O set off half the width of the rail; strike the mould; make the joints square with the tangents.

Fig. 5 is the face mould for the piece, starting from the level floor; make P R equal P R, Fig. 2, and R H equal 2 3, Fig. 1; draw the straight wood, which may be any length. The bevel for this is seen in the angle at R, Fig. 2; the mould at P is the same width as the rail; the tangent R H falls on the dotted line made on the plank, so that R P moves forward. This shows the reason why the mould at P is made the same width as the rail; the compasses will strike this mould; the joints are made square with the tangents.

Fig. 6 shows the ground plan landing. Fig. 7 shows the elevation landing, and is simply the reverse of Fig. 2, so that the wreath starting also answers for landing. Fig. 8 shows the carriage landing. Fig. 9 shows the carriage starting.

PLATE X.

Fig. 1 exhibits the plan of a staircase, with winders and landing in the semi-circle; then starting with square steps.

The centre line of the rail given; the tangents which enclose the circle, are unfolded at Fig. 2. This is done in the same manner as laying out a string. Observe that the position of the winders, where they cut the tangent lines on the plan, are also unfolded. The diagonal line O 5 is the ordinate for the lower wreath piece. The line from the baluster S, draw parallel with the ordinate; then the dotted perpendicular shows its position on the elevation. On this principle, the positions of all the balusters in the circle are obtained, and their lengths found from the elevation. For example; if the under side of the rail be drawn, the distance between this and the top of a step added to a short baluster, is the required length of those in the circular part. For this reason, the pitches on the elevation truly represent the centre of the rail and plank; these are retained in the wreath, when over its plan, from the fact of this being taken from the centre of the plank, through which the pitches pass; then the ordinate in every case gives a positive direction for the position of both balusters and winders on the elevation. The value of this is of the utmost importance, especially when the balusters are metal, and their length required. The upper part of the wreath on this plan forms its own ramp; let the under side of rail on the common pitch rest on the centre of short baluster; set off half its thickness; this draw indefinite. The upper part having cut at P, determines a point from which to draw the pitch over the winders; this being P X, make the balusters under the wreath equal in length, but remember that this pitch is entirely discretionary; it may be raised or lowered from P. To draw the mould at Fig. 3, make 2 3 4 equal two sides of a square, the same as plan, Fig. 1; make 3 J equal J 3, Fig. 2; from J draw a line through 4 indefinite; this gives the ordinate. Draw lines from 2 and 3 parallel with it; draw H P square with H 4, cutting the angle 3; make H 6 equal V 2, Fig. 2; join 6 P, which gives the major axis. Let Fig. 4 be a piece of board for the mould; on its edge mark 6 O P the same as Fig. 3; square over the lines; make P 2 equal P 2, Fig. 3, and 6 H equal H 4; join O 2 H; draw S H parallel with O 2, and S 2 produced parallel with H O; these to be correct, H S 2 must equal 2 P 4, Fig. 2. To find the bevel for the joint N, take W, Fig. 2, for centre, and for radius a tangent curve with the extended line 2 P; draw the circle to cut at N; join N V, and in the angle is the bevel; from which the width of the mould is obtained, by drawing a line from V square with V N; on this set off half the width of the rail, which square over to K; then V K is half the width of the mould; this set off on each side of N, Fig. 4; draw the straight wood parallel with N 2; the straight wood may be any length desired; the bevel for joint H is obtained from centre 3, Fig. 2; the radius a tangent curve with P J, cutting at P; join P 2, and in the angle is the bevel. The width of the mould is found by drawing a line from P square with P 2; on this set off half the width of the rail; from which square over to cut P 3, which is half the width of the mould; this set off on each side of H, Fig. 4; on each side of O set off half the width of the rail; now strike the mould; remember that O O is always equal to the radius on the plan; make the joints square with the tangents. The face mould for the lower part of the wreath. Let Fig. 5 be a piece of board for this; square over the line O 5, which equals O 5 on the plan; take 5 R, or 5 4, Fig. 2, for a radius; with this, and centre O, Fig. 5, make the arc of a circle at R and 4; then take 5 for centre, and intersect the arcs; from 5 draw a line through R and 4. The width of the mould and bevel is found at Fig. 2, by taking 6 for centre, and for radius a tangent curve with 5 R, cutting at C; join C 5; in the angle is the bevel for both joints of Fig. 5. The width of the mould is obtained by drawing a line from C square with C 5; on this set off half the width of the rail, from which draw a line parallel with C 5, cutting C 6; this gives half the width of the mould; this set off on each side of P and 4, Fig. 5; the minor axis O O equals the radius on the plan; then on each side of O set off half the width of the rail, and strike the mould; the joints square with the tangents; the line through R is drawn from centre O; the application of the mould and bevels has been stated.

P. S.—If the circle is to have winders all round, make a winder on both sides the same as 6; the face moulds, &c., are found on the same principle.

PLATE X

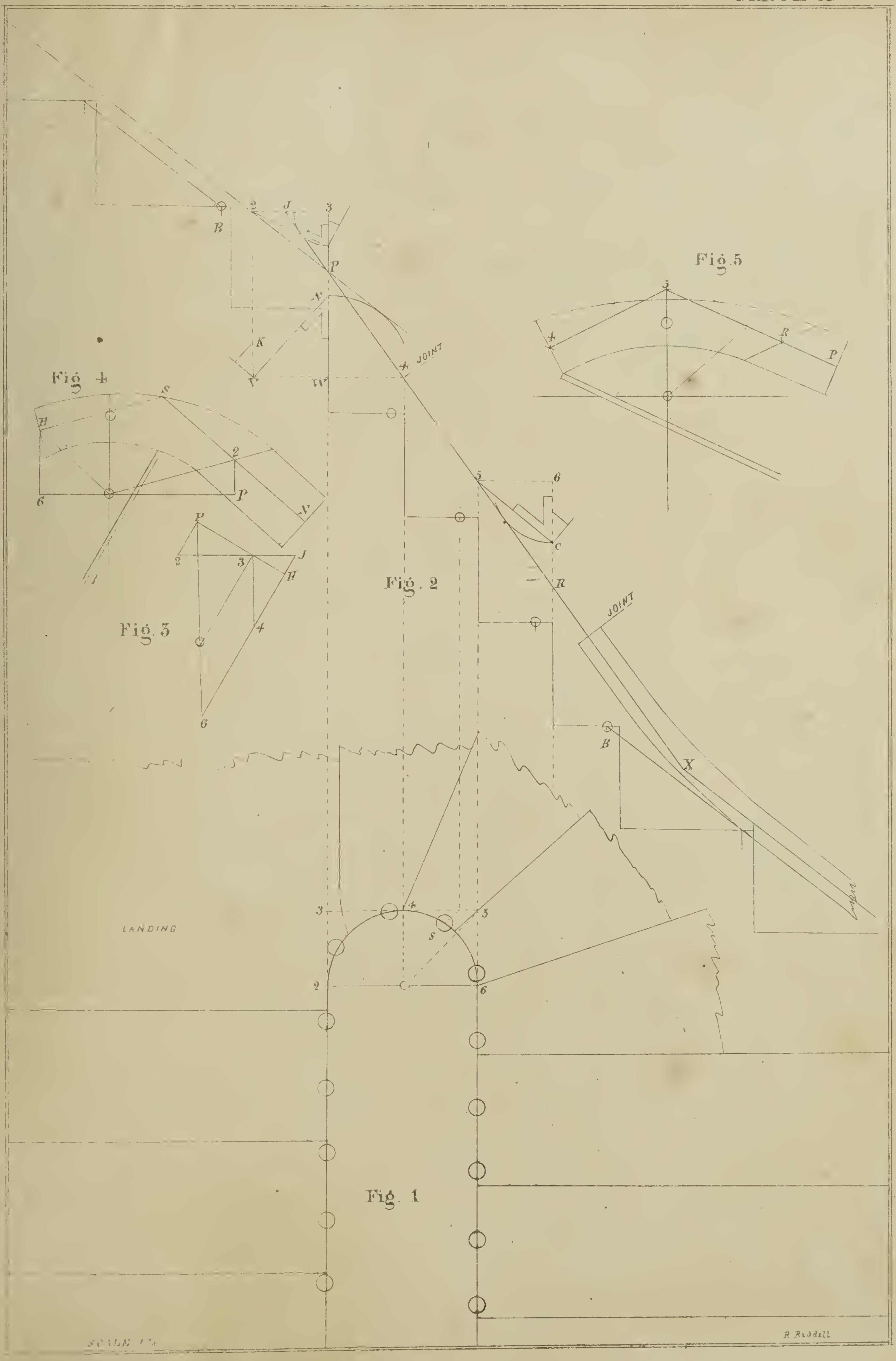


Fig. 5
5
4
R
P
Fig. 4
S
B
2
6
P
N
Fig. 3
P
2
3
J
H
4
6
Fig. 2
B
2
J
3
P
N
K
L
W
4 JOINT
5
6
C
R
JOINT
B
X
LANDING
3
4
3
S
2
6
Fig. 1
SCALE
R Riddell

PLATE XI

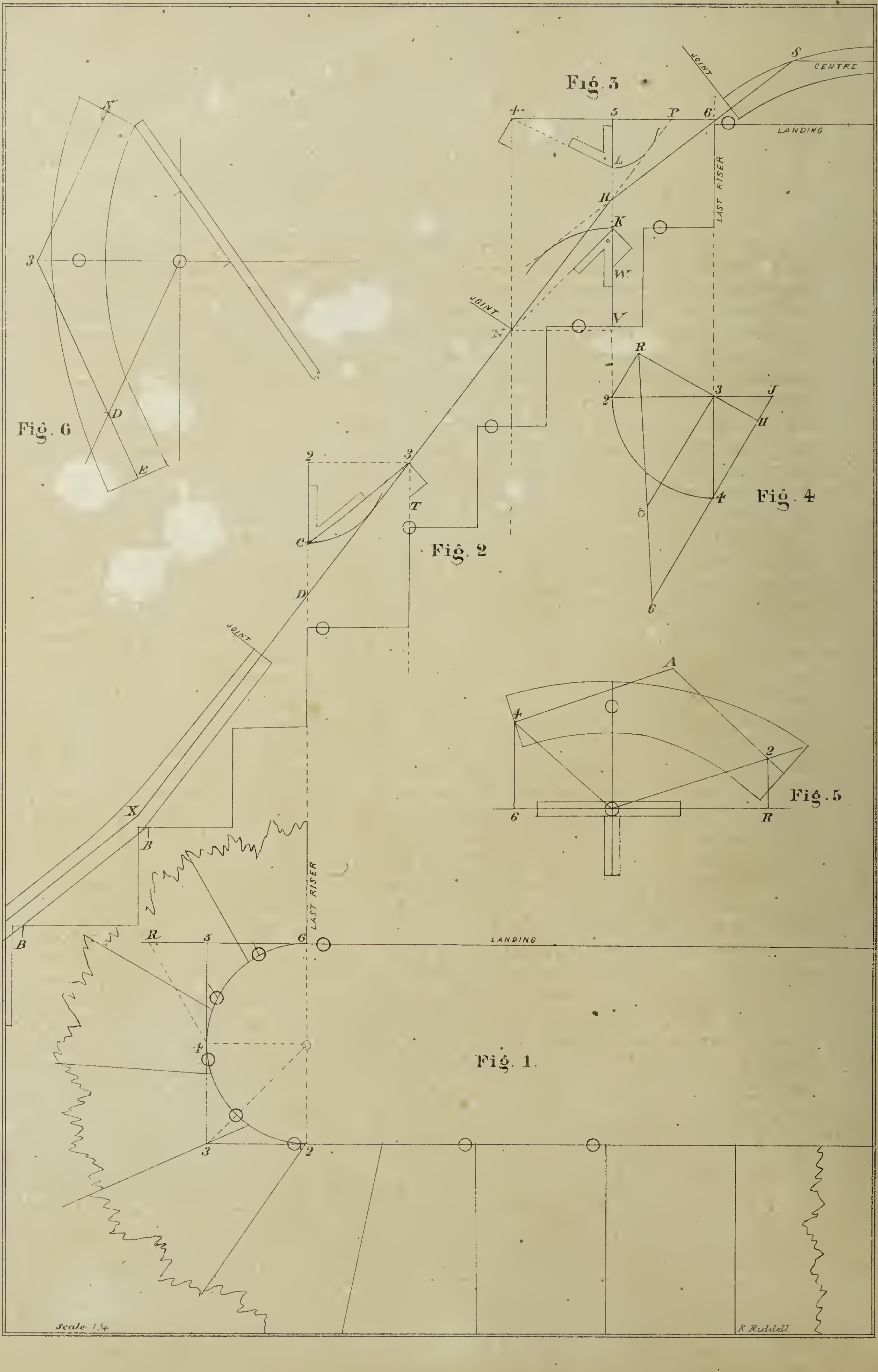


Fig. 3
JOINT
S
CENTRE
4
5
P
6
LANDING
L
H
K
LAST RISER
W
JOINT
N
V
Fig. 6
N
3
D
E
R
2
3
J
H
Fig. 4
4
6
2
3
T
C
Fig. 2
D
JOINT
A
4
2
Fig. 5
6
R
X
B
LAST RISER
B
R
5
6
LANDING
4
Fig. 1.
3
2
Scale 1/4
R Riddell

PLATE XI.

Fig. 1 is the ground plan of a staircase, with winders around the semi-circle, the last winder and the landing connecting. The circle enclosed by tangents. These and the winders are unfolded or spread out at Fig. 2, on the same principle as laying out a string; below the winders is seen the elevation of a square step with the under side of rail resting on the centre of short balusters B B; set off half its thickness; then, at the landing, set off centre of level rail; its under side make equal to half a riser above the floor. The pitches from the ramp on the landing to that on the lower part of the winders, are entirely discretionary; the curve from the landing to the wreath should be made as if seeming to flow out of the latter. To do this, assume S H for the upper pitch, and H X for the lower pitch. The pupil will notice that if the last riser were further on the landing, this would give more control over the pitches and the ramp, but we are supposing its present situation insisted upon; then S H D represents the centre of the wreath over the winders; this being determined, the position of the balusters on the tangents of the plan are found at Fig. 3, by drawing 4 6 square with last riser; produce D H, cutting P; then make R 6, Fig. 1, equal 4 P; join R 4; this is the ordinate for the upper part of the wreath, and the ordinate for the lower part is the diagonal line O 3. From centre of balusters draw lines to cut the tangents parallel with the ordinates. The distances which these give on the tangents, are transferred to the winders on the elevation, Fig. 2, so that by drawing the under side of the rail, we have the exact length of each baluster. Proceed to draw the face moulds; that for the upper piece of wreath is found at Fig. 4; make 2 3 4′ equal two sides of a square the same as on the plan; make 2 J equal 4 P, Fig. 3; from J draw a line through 4; this gives the ordinate. Draw lines from 2 3 parallel with it; draw R H, cutting 3, and square with J 4; make H 6 equal N 4, Fig. 3; join 6 R; this is the major axis. Let Fig. 5 be a piece of board for the mould; mark on its edge 6 O R the same as that at Fig. 4; square over the lines, and make 6 4 equal H 4, Fig. 4; make R 2 equal R 2; join O 2 4; draw 4 A parallel with O 2, and A 2 produced, parallel with O 4; these to be correct, 4 A 2 must equal N H 6, Fig. 3. The minor axis being O O, is equal to the radius of the plan. On each side of O set off half the width of the rail; find the width of the mould and bevels at Fig. 3. That for the joint 4, take 5 for centre, and for radius a tangent curve with P H, cutting L; join L 4; in the angle is the bevel is required. That for the joint 2. Square over the dotted line N V, take V for centre, and for radius a tangent curve with 6 H produced; draw the circle to cut K; join K N; in the ange is the bevel. The width of the mould is obtained, by drawing a line from K square with K N; on this set off half the width of the rail, which square down to cut at W; then W K is half the width of the mould; this set off on each side of the joint at 2, Fig. 5; now strike the mould, and make its joints square with the tangents. Find the mould for the lower part of the wreath. Let Fig. 6 be a piece of board for this; square over O 3; make this equal to O 3 on the plan; then at Fig. 2, take 3 N or 3 D for radius; with this, and 3 O, Fig. 6, for centres, make intersections at D N; through these draw lines from 3; also a line from O, through D; make O O equal the radius on the plan, and on each side of O, set off half the width of rail. The width of the mould, and the bevel for the joints, are found at Fig. 2. Take 2 for centre, and for radius a tangent curve with 3 D, cutting C; join C 3; in the angle is the bevel. From 3 draw a line square with 3 C; on this set off half the width of the rail, from which square down to T; then T 3 is half the width of the mould; this set off on each side of E and N, Fig. 6; draw the shank parallel with E D; then set the trammel or straight edge, and strike the mould; make the joints square with the tangents.

PLATE XII.

Fig. 1 is the plan of a staircase, landing on a level floor. Stairs of this description are held in high estimation in both England and the United States, owing to the fact that less room is taken up in their construction than any other kind, and, above all, they can be made to produce a most pleasing effect with the least possible expense.

It will be observed on the plan, that the tangents which enclose the circle, are 2 3 4 H P; then H P being on the landing, will be a level line on the elevation, so that we will unfold the tangents on a board or the bench in the same manner as laying out a string. Fig. 2 shows this, which is the elevation of the winders with one or two square steps. The position of the tangents, as they are on the plan, is also seen, indicated by the same numbers; the under side of the rail is made to rest on the centre of the short balusters B B, which is the first square step below the winders; now set off half the thickness of the rail; this draw indefinite; then at Fig, 3, draw the centre of level rail on the landing; the height from the landing to its under side is half a riser, so that H is a point determined; from this a line is drawn through P; from P a line is drawn to X. These are the pitches, which are entirely discretionary, that is to say, from H to the centre of rail on the square step. By this arrangement, it will be seen that the lower part of the wreath will have two pitehes; this will produce a much better effect, than a straight line, from H to X. The pitches being determined, the position of the balusters on the elevation can be given, also their length, simply by finding the ordinate for the lower wreath piece. This is obtained at Fig. 2; square over 2 T; produce H P to cut R; then make 4 E, Fig. 1, equal T R, Fig. 2; join E 2, which is the ordinate, from which the face mould could be drawn at once, but this we defer, for the purpose of saying a word about the balusters. It is understood that the upper part of the wreath falls level and makes its own ramp over P H; then the balusters between P H and H 4 are right angles with the two tangents; not so with the balusters between 4 3 2; these centres are drawn to cut the tangents parallel with the ordinate E 2; then we have only to transfer their centres from the tangents on the plan, to the elevation, Fig. 2; and by drawing the under side of the rail, we have the length of each baluster; to make this clear, A B is the under side of the rail resting on the centre of a baluster; then the distance between the step and rail added to a short baluster, is the length of that which A B rests on. Now proceed to draw the mould for the lower part of the wreath; let 2 3 4, Fig. 4, be two sides of a square to equal 2 3 4, Fig. 1; make 4 6 equal T R, Fig. 2; from 2 draw a line through 6; this is the ordinate. Draw lines from 3 and 4 parallel with it; draw 5 N square with 2 6, cutting the angle 3; make 5 K equal S 3, Fig. 2; join K N, which is the major axis. Let Fig. 5 be a piece of board for the mould; mark on its edge K O N, the same as Fig. 4; square over the lines; make N C equal N 4, Fig. 4; make K A equal 5 2; join O A C; draw A D parallel with O C; draw D C produced, parallel with O A. These to be correct, A D C must equal 2 P 4, Fig. 2; make O O equal to the radius on the plan; on each side of O set off half the width of the rail; find the width of the mould at A and B from the bevels; these are obtained at Fig. 2. The bevel for the joint B. Take 3 for centre, and for radius a tangent curve with the produced line 2 P, cutting at J; join J 4, and in the angle is the bevel. Find the width of the mould by drawing a line from J square with J 4; on this set off half the width of the rail, which square over to cut at V; then J V is half the width of the mould; this set off on each side of B; draw the straight wood parallel with C D. The bevel for the joint A. Take S, Fig. 2, for centre, and for radius a tangent curve with P R, cutting at O; join O 2, and in the angle is the bevel. Find the width of the mould by drawing a line from O square with O 2; on this set off half the width of the rail, from which square over to cut the line S O; this is half the width of the mould, which set off on each side of A, Fig. 5; now strike the mould, and make the joints square with the tangents. Find the mould for the upper part of the wreath. At Fig. 6, make O O equal the radius on the plan; make O A equal H 4, Fig. 3; on each side of O set off half the width of the rail. The width of the mould at B, and bevel for the joint is found at Fig. 3; set off from H, half the width of the rail; square this down to cut at J; then H J is half the width of the mould; this set off on each side of B; draw the straight wood parallel with B A; four or five inches of straight wood will be sufficient to leave on the mould; at Fig. 3, the bevel is seen in the angle; make the joints square with the tangents; the plank need not be cut to the whole width of the mould at B. The square section which is marked by the bevel, explains this: the dotted line from the outside of the rail on the section, mark this on the face of the plank, then, on applying the mould, make its outside edge 3 3, fall over the dotted line on the plank.

PLATE XII

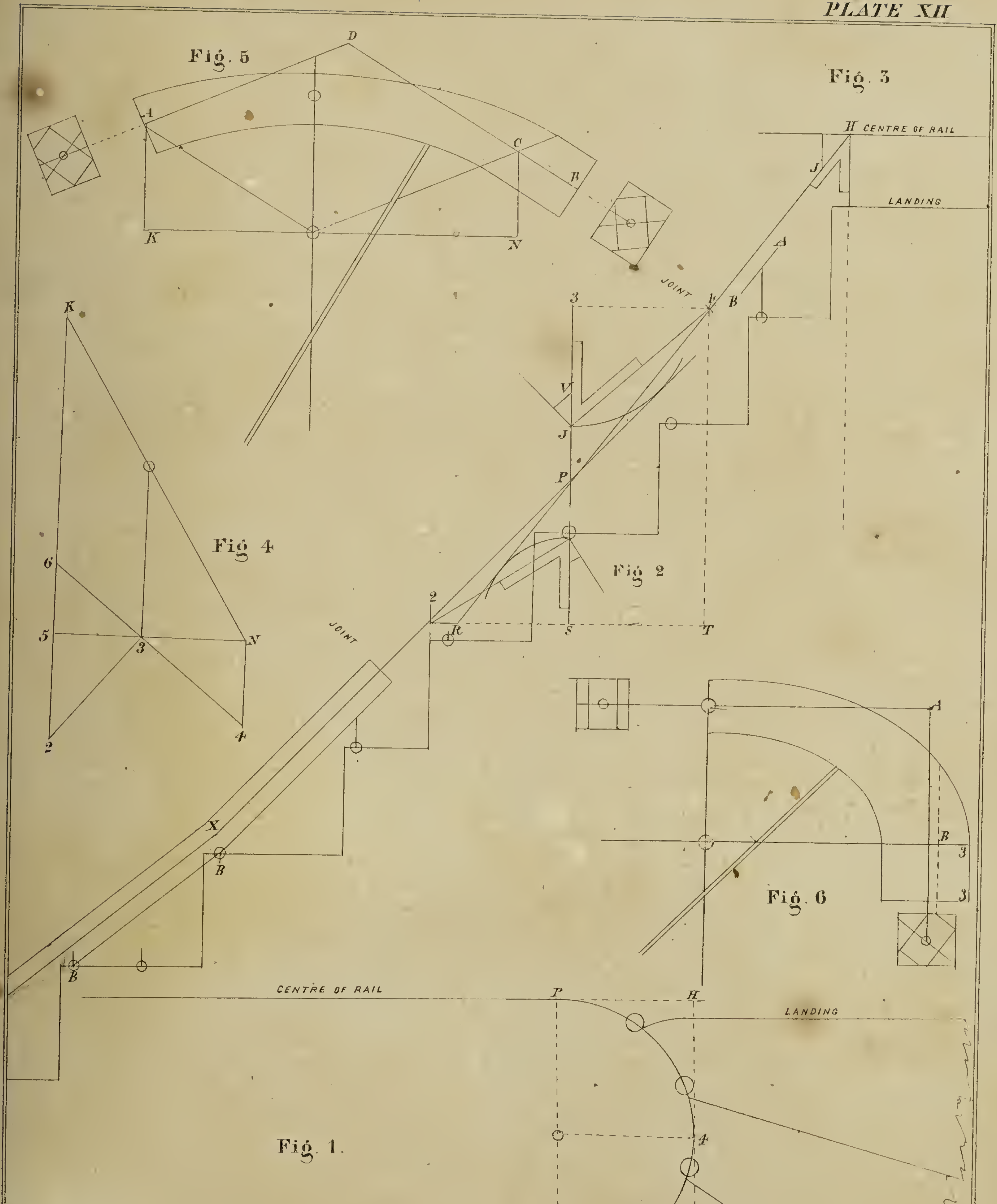


Fig. 5
D
A
C
B
K
N
Fig. 3
H CENTRE OF RAIL
J
LANDING
A
B
JOINT
3
F
V
J
P
Fig 2
2
R
S
T
Fig 4
K
6
5
3
N
2
4
JOINT
X
B
B
Fig. 6
A
B
3
3
CENTRE OF RAIL
P
H
LANDING
Fig. 1.
4
2
3
E
SCALE 1/2
R Riddell.

PLATE XIII

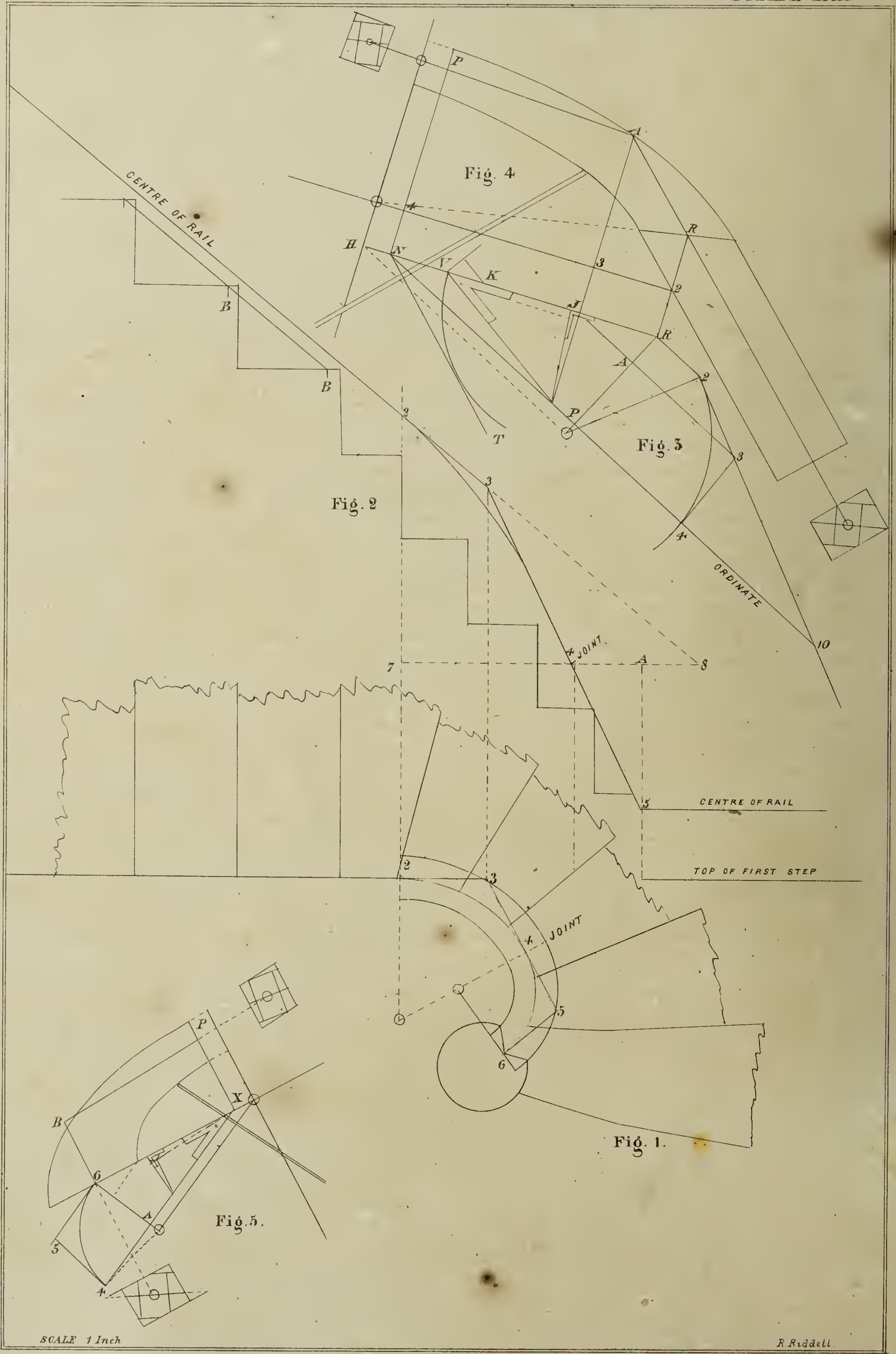


Fig. 4
P
A
4
H
N
V
K
J
R
3
2
R
A
P
2
T
Fig. 3
3
4
ORDINATE
10
CENTRE OF RAIL
B
B
2
3
Fig. 2
7
4 JOINT.
A
8
5
CENTRE OF RAIL
TOP OF FIRST STEP
2
3
4 JOINT
5
6
Fig. 1.
P
X
B
6
A
5
4
Fig. 5.
SCALE 1 Inch
R. Riddell.

PLATE XIII.

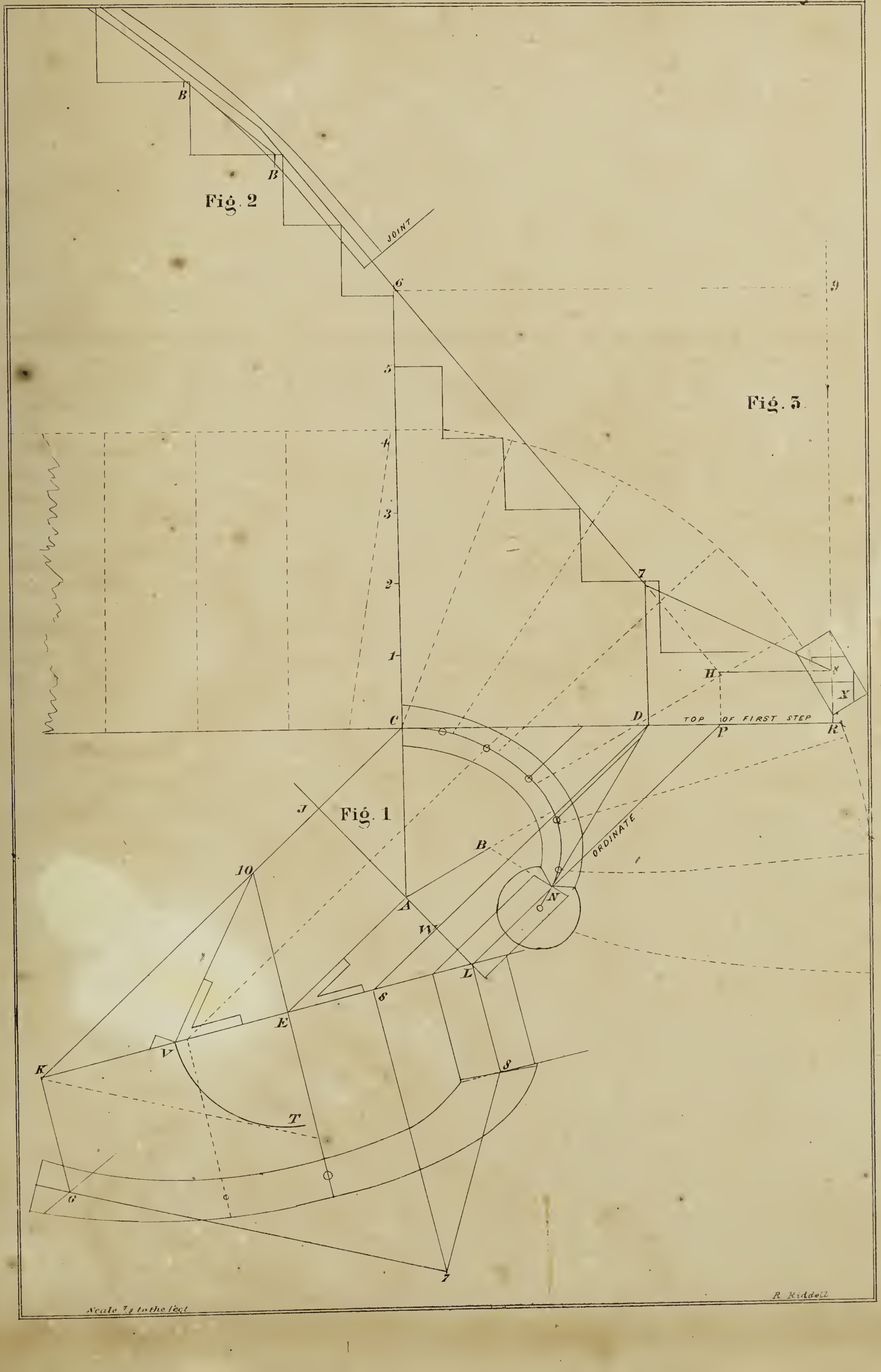
Fig. 1 is the lower part of a staircase—the rail starting from a newel. The arrangement of this plan is such that it will make a very superior job, and cost no more than those common affairs that disgrace so many of our private and public buildings in the interior finish. It will be noticed that the plan of steps and rail are struck from two centres; the radius not limited; the joint made at the junction of the two circles; this makes the tangents 2 3 4 5 6; that from the newel, which is 5 6, will be level, when in position, and 5 4 3 will be a pitch over the winders, and 2 3 the common pitch over the flyers. The tangents and winders are unfolded at Fig. 2, in the same manner as laying out a string; let the under side of the rail on the flyers rest on centre of short balusters B B; set off half its thickness; this draw indefinite; then set off from top of first step, the centre of level rail; draw this to cut at 5; join 3 5; through the centre of joint 4, draw the line 7 8 square with 7 2. The face-mould for the upper part of the wreath is obtained at Fig. 3; make 2 3 4 0 to equal the same figures on the plan; make 2 10 equal 7 8, Fig. 2; from 10 draw a line through 4 indefinite; this gives the ordinate. Draw lines from 2 3 parallel with it; draw centre O and R square with the ordinate; make P N equal 7 2, Fig. 2; join N R produced both ways; this gives the major axis. Its centre is found by drawing O H parallel with P N. Let Fig. 4 be a piece of board for the mould, and O 2 a line for the major axis; square over the lines; make 2 R equal R 2; make 3 A equal A 3, and 4 P equal P 4; join P A and A R produced; these, to be correct, must equal 2 3 4, Fig. 2. The bevel for the joint on the wide end of the mould, and its width, is found by drawing N T parallel with A R, and making J P square with J R; take J for centre, and for radius a tangent curve with N T, cutting at V; join V P, and in the angle is the bevel. Find half the width of the mould, by drawing a line from V square with V P; on this set off half the width of the rail, which square down to K; then K V is half the width of the mould; the bevel for the joint P is found by drawing a line from N parallel with P A; take J for centre, and for radius a tangent curve with the line from N; draw the circle to cut at J; join J P; in the angle is the bevel; make O O equal with O 2 or O 4 on the plan; on each side of O set off half the width of the rail; then strike the mould, and make its joints square with the tangents; this piece of wreath makes its own ramp, and the straight part may be any length desired. The mould for the piece of wreath starting from the newel, is found at Fig. 5; make 0 4 5 6 equal the same numbers on the plan; then 5 6 will be the ordinate; make O 6 square with this; draw 4 A produced, parallel with 5 6; make A X equal 5 A, Fig. 2; join X 6 produced both ways; this is the major axis. Square over X P and 6 B; make X P equal A 4, and 6 B equal 6 5; join P B; this, to be correct, must equal 4 5, Fig. 2; find the centre of the trammel by drawing O O parallel with A X; the joint at 6 being on the major axis, its bevel is contained in the angle A 6 X; the bevel for the other joint is found as usual; now strike the mould. Its application and the bevels are precisely the same as that given for plate II.

PLATE XIV.

The motive for introducing this plate isthat many workmen entertain the idea that the wreath starting from a newel over winders, should be without a joint. The objection to this is, that the easing from the mitre cap is short and abrupt, and we have not the same control over the pitches and heights, as when there is a joint, yet there may be positions, where it would be desirable to introduce this, so that in such cases the plan given will apply.

Fig. 1 is the plan of the steps and rail struck from the centres A and B, which make the tangents C D N; then make D R equal D N; now square up lines from C D R; then make C 6 equal six risers, the same as on the plan, (the first riser not counted.) At Fig. 2, make the under side of the rail to rest on the short balusters B B; set off half its thickness; this draw indefinite; now assume 8 7 as the pitch from the newel, (observe that this stands over the tangent N D on the plan.) From 7 draw a line through 6, cutting centre of rail on the square steps; the pitches being determined, draw a line from 8, cutting the produced line 6-7 at H; square down H P; draw the line P N, which gives the ordinate; draw lines from D and C parallel with it; draw a line through A at right angles with the ordinate; make J K equal 8 9, Fig. 3; join K L; then square over the lines L S E K; make L 8 equal L N; make S 7 equal W D; make E O equal A C, and K 6 equal J C; now join 6 7 8; these, to be correct, must equal the same numbers on the elevation. The mould is now traced in the usual way, by drawing ordinates; if desired, the wreath can be bored for the balusters before it is squared, simply by drawing ordinates from the centre of each baluster on the plan, and these set off on the centre of the mould; the bevel for the joint on the straight wood at 6, is obtained by drawing the line K T parallel with 6 7; then take E for centre, and for radius a tangent curve with K T, cutting at V; join V 10, and in the angle is the bevel. The bevel for the lower end is in the angle E A L; make the joint at 8 parallel to L K, and square with the face of the plank. The section of the rail and the application of the bevel is seen at Fig. 3; the centre line through 8 is the point of mitre; the slab X, cut off square with the joint; mark the mitre on the under side. The application of the mould and bevels is the same as that which has been given on Plate II.

PLATE XIV



Scale $\frac{7}{8}$ to the feet

R. Riddell

PLATE XV

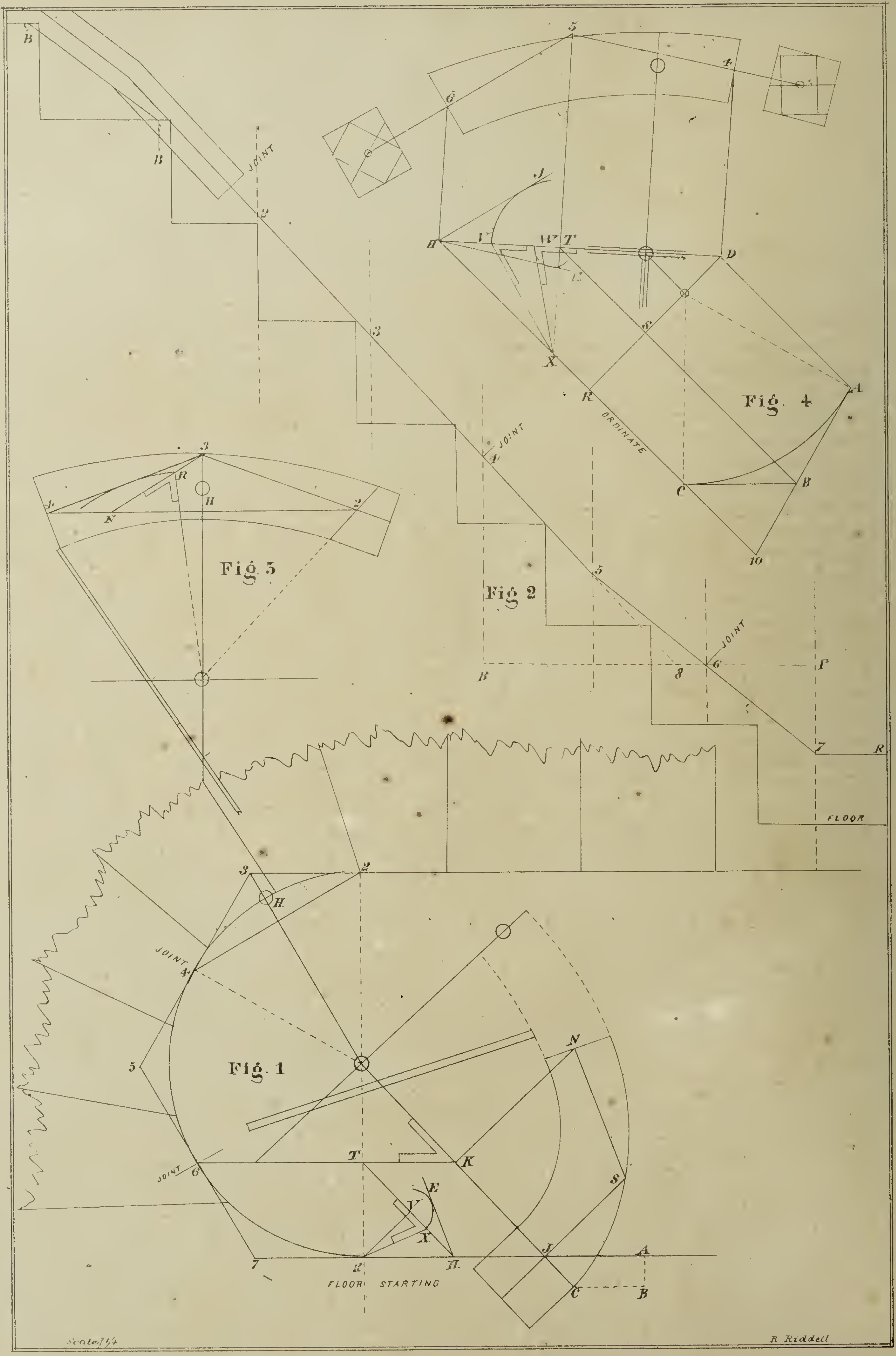


Fig. 1
Fig 2
Fig 3
Fig. 4
JOINT
ORDINATE
FLOOR
FLOOR STARTING
A
B
C
D
E
H
J
K
N
P
R
S
T
V
W
X
1
2
3
4
5
6
7
8
10
Scale 1/4
R. Riddell

PLATE XV.

Fig. 1 is the plan of a stairs, with winders starting from a level floor, the wreath in three pieces.

The tangents which enclose the centre line of the rail, are 2 3 4 5 6 7; the tangent 7 R will be a level line; these and the winders, are seen unfolded at Fig. 2, done in the same manner as laying out a string. Let the under side of the rail rest on the short balusters B B, (of the square step;) set off half its thickness; this draw indefinite. Set off above the floor, the centre of level rail 7 R; draw the pitch 2 5; join 5 7. The pitches are now in position. Draw the face mould for the upper part of the wreath; at Fig. 3 make O O 3 H equal O O 3 H, Fig. 1; through H, draw 4 2 square with O O. Take 2 3 or 3 4, Fig. 2, for radius; with this, and centre 3, Fig. 3, intersect the line through H, at 2 4; join 3 4 and 3 2 produced. The tangents being equal, one bevel answers for both joints. Find this, by making 3 N equal 2 3 on the plan. Take O for centre, and for radius, a tangent curve, with 3 4 cutting R; join R O, and in the angle is the bevel. On each side of O, set off half the width of the rail. Find the width of the mould at the joints, by the method given. The straight wood that joins the ramp, this draw parallel with 2 3; make the joints square with the tangents, and strike the mould.

The middle piece that stands over 6 5 4, on the plan, has two pitches, as seen on the elevation. The mould for it is obtained at Fig. 4. Make A B C equal 4 5 6, Fig. 1; make A 10 equal B 8, Fig. 1; from 10 draw a line through C indefinite; draw lines from A B parallel with 10 C; make R D through centre O, square with R C; make R H equal B 4, Fig. 2; join H D, which is the major axis. Square over lines from D O T H; make D 4 equal D A, and T 5 equal S B, and H 6 equal R C; join 4 5 6. These, to be correct, must equal 4 5 6, Fig. 2. Make O O equal the radius O A. On each side of O, set off half the width of the rail. Find the bevels for the joints 4 and 6. That for 6, draw H J parallel with 6 5, with T for centre, and for radius, a tangent curve, with H J cutting at V; join V X, and in the angle is the bevel. That for 4, draw a line from H parallel with 5 4, then take T for centre, and for radius, a tangent curve, with H E cutting at W; join W X, and in the angle is the bevel. From the bevels find the width of the mould at the joints; these make square with the tangents. Take the trammel or straight-edge and strike the mould.

The next mould will be for the piece starting from the floor, standing over 6 7 R, Fig. 1, so that 7 R is the ordinate. Draw 6 T parallel with it; make R O square with R 7; make R H equal 7 P, Fig. 2; join H T; draw O J parallel with T H; square over lines from O K J; make J S equal R 7; make K N equal T 6; make O O equal O O; join N S and S J produced. These, to be correct, S N must equal 6 7, Fig. 2, and S J fall level over R 7, Fig. 1. Find the width of the mould at J, by making A B equal half the width of the rail. Draw B C parallel with A J, cutting K J produced; then J C is half the width of the mould. Set off the other half; then, on each side of O, set off half the width of the rail; strike the mould. Find the bevel for the joint N; make R V square with H T; draw H E parallel with S N; take V for centre, and for radius, a tangent curve, with H E cutting X; join X R, and in the angle is the bevel. That for the wide end of the mould is in the angle K T O.

PLATE XVI.

Fig. 1 is the plan of a staircase, the sides of which, if extended, make the acute angle; the centre line of the rail being given, and enclosed by the tangents 2 3 4 5 6; these and the winders are unfolded at Fig. 2. The wreath to be in two pieces, the upper part to form its own ramp; then make the elevation of a square step at the lower and upper ends of Fig. 2. Let the under side of rail rest on the short balusters B B; set off half its thickness; this draw indefinitely. The upper pitch having cut at 3, determines a point from which to draw the next pitch. The situation of the winders at once show, that in order to have the balusters a proper length, we must keep the rail down at the lower ramp, so that the pitches may be assumed, 3 5 6. Through the joint 4, square over the line A D. Now draw the face mould for the upper part of the wreath, by making 2 H, Fig. 1, equal A D, Fig. 2. Draw the ordinate H 4 indefinite; from 3 and 2, draw lines parallel with it. From O, the centre, draw O V square with A 3; make V T equal A 2, Fig. 2; join T N; make O P parallel with N T, which is the major axis. Square over lines from O H R P; make O O equal O O, and H 4 equal N 4; make R 3 equal A 3, and P 2 equal V 2; join 4 3 and 3 2 produced. These, to be correct, 2 3 4 must equal 2 3 4, Fig. 2. Find the bevel for the joint B, by drawing a line from X, parallel with B 2; take W for centre, and for radius, a tangent curve, with X C cutting E; join E S; extend this to J, and in the angle is the bevel. That for the joint 4; draw a line from R, parallel with 3 4; take H for centre, and for radius, a tangent curve, with the line from R cutting C; join C S, and in the angle is the bevel. From the bevels find the width of the mould, and strike it. Make the joints square with the tangents.

The mould for the lower part of the wreath is found at Fig. 3. Make 4 5 6 equal 4 5 6 on the plan; make 6 P equal V S, Fig. 2; from P draw the ordinate through 4 indefinite; draw lines from 5 and 6, parallel with it; draw R W through O, and square with R P; make W K equal 6 S, Fig. 2; join K R, which gives the major axis; square over lines from R O N K; make R H equal R 4; make O O equal O 6, and N X equal J 5; make K V equal W 6; join H X and X V produced. On each side of O set off half the width of the rail. Find the width of the mould and the bevels, by the method already given. Make the joints square with the tangents. Strike the mould.

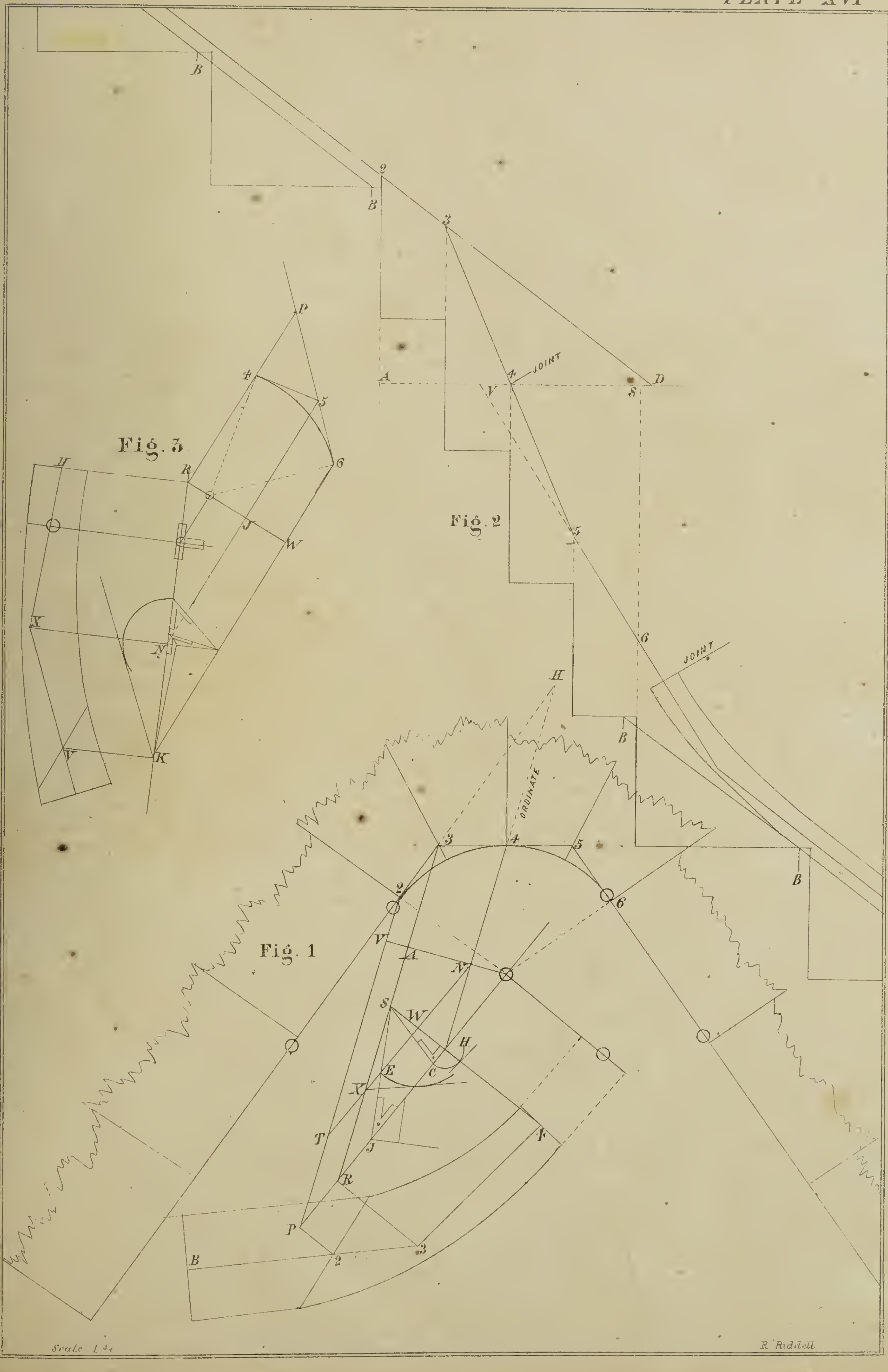
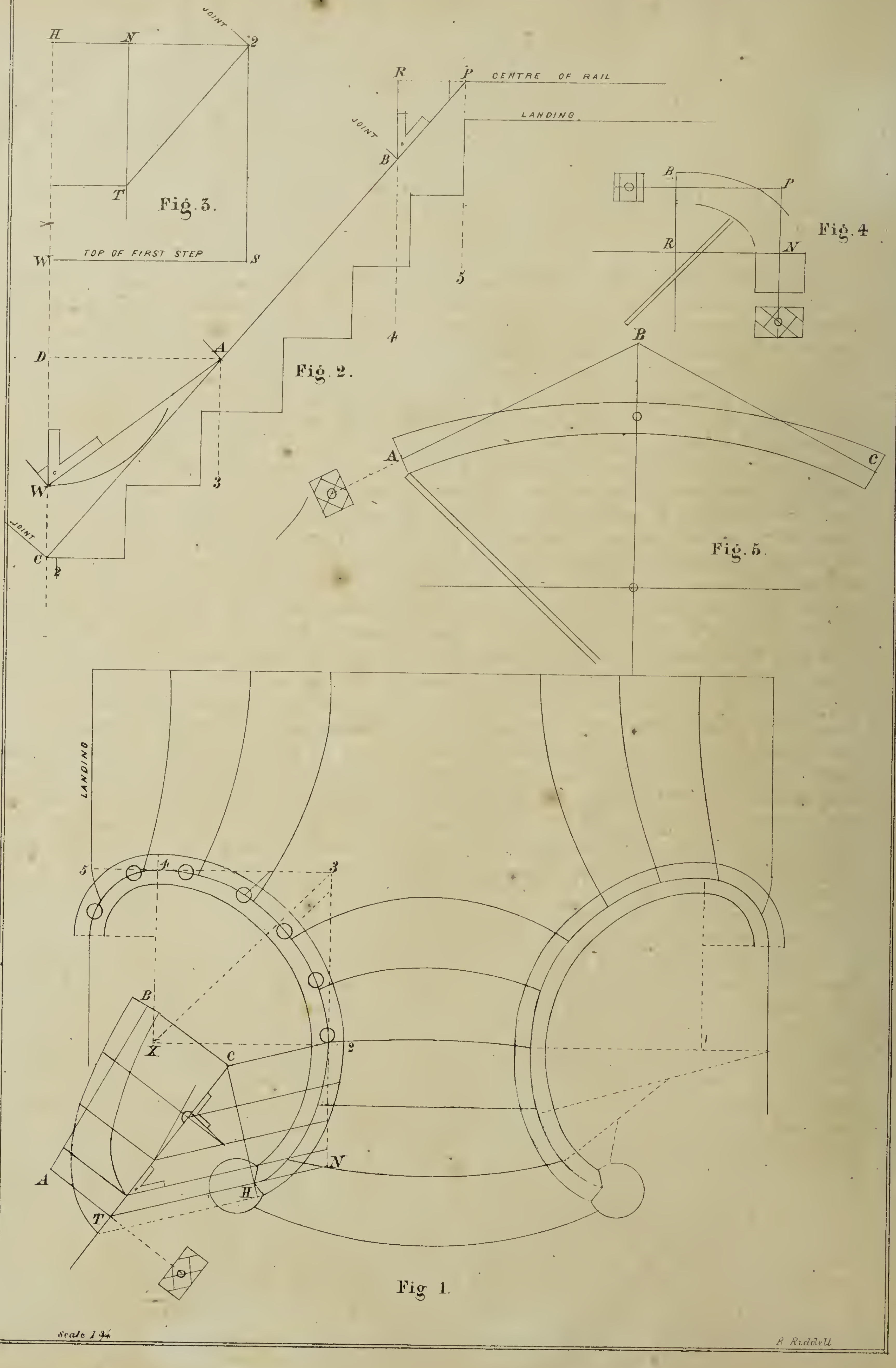


Fig. 3
P
4
5
6
H
R
J
W
X
N
V
K
Fig. 2
B
2
B
3
A
4
JOINT
V
S
D
5
6
JOINT
H
B
B
Fig. 1
ORDINATE
3
4
5
2
6
V
A
N
S
W
H
E
C
X
T
J
R
F
P
2
3
B
Scale 1 3/4
R Riddell

PLATE XVII



Scale 1 ¾

F. Riddell

PLATE XVII.

Fig. 1 is the plan for ship or steamboat stairs. The space allotted for these is generally very limited. This requires some judgment, not only in the design, but other arrangements. The author having had considerable experience in this kind of work, it may not be out of place to mention, that in fitting it up, the plumb-rule or level will not apply, so that everything should be done in the shop; and when taken to the vessel, whatever points or positions may be wanted, are ascertained with a square and straight-edge, from the carline or beam.

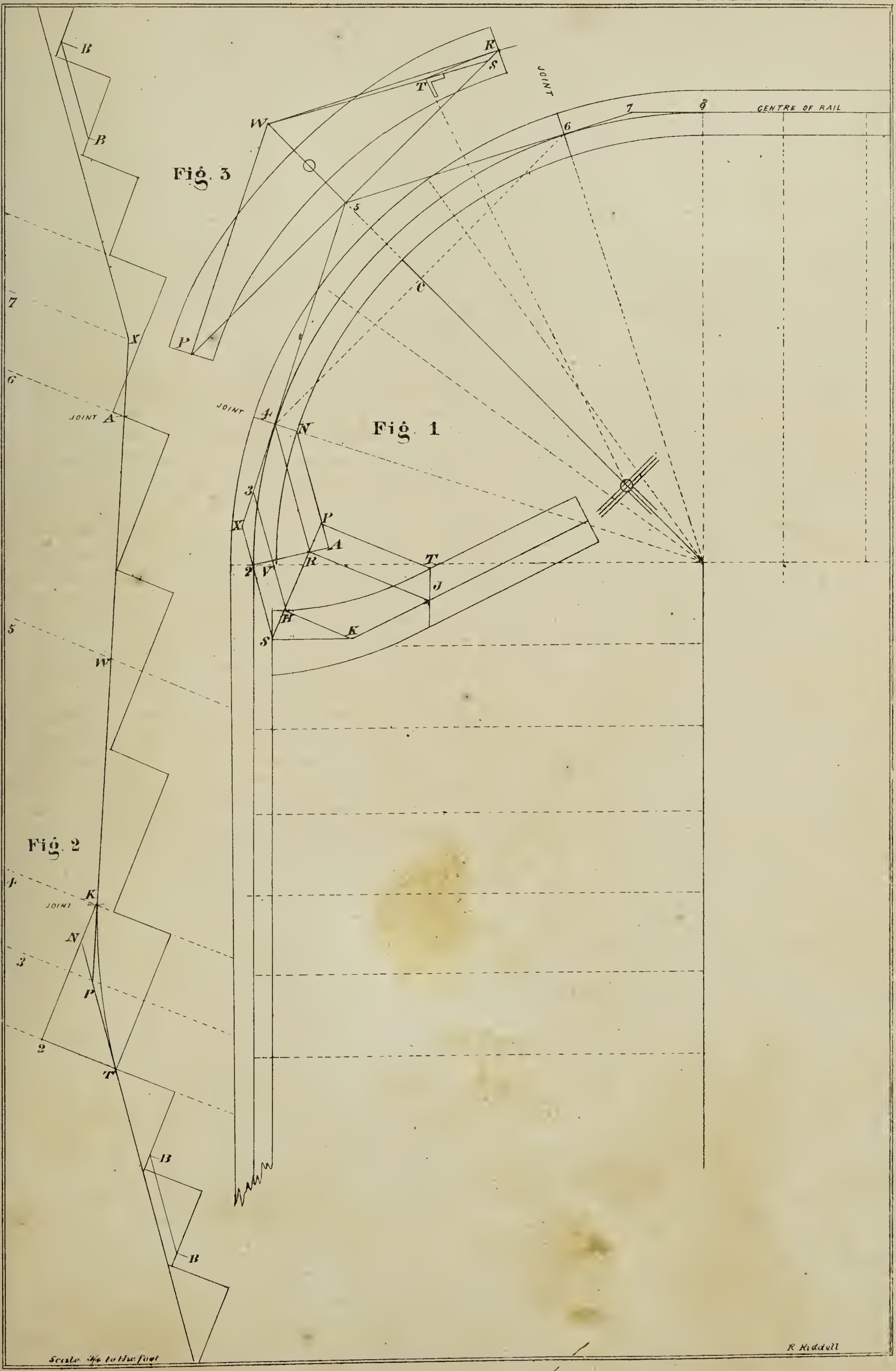
The plan before us is extremely simple in its construction, and when finished will produce a good effect. Observo that the joints for the rail are made at 2 and 4; by this arrangement two pieces of the wreath are quarter-circles of different radii. The piece starting from the newel is made of various curves; in fact the whole plan is a matter of fancy, so that we shall commence to draw the moulds without further remark. That part of the wreath which stands over the large quarter-circle; notice that the diagonal line X 3 will be the ordinate. The lines from the centre of each baluster cutting the tangents, are in the same direction. Then the exact position of the balusters can be given on the elevation, by unfolding the tangents 2 3 4 5, and which is seen at Fig. 2, being the same numbers as those on the plan. The pitches are now drawn. The centre of level rail above the landing is seen to cut at P. This determines a point to draw the pitch over the winders. Suppose the lower part of the wreath be made to rest on the baluster 2, its position is the same as that on the plan; then P C is the pitch. This arrangement makes the balusters from 2 to that on the last step, longer. This, however, is not objectionable, but rather an advantage, owing to the fact of the steps being curved from the upper landing. This pushes, as it were, the whole of these steps forward, so that in this or any similar case, the rail should be raised. To draw the mould for the piece of wreath that stands over the large quarter-circle, let Fig. 5 be a piece of board for this; make O B equal X 3 on the plan; then, at Fig. 2, take A B or A C for radius, with this and O B, Fig. 5, for centres, make intersections at A C; through these draw lines from B; make O O equal X 4 on the plan. On each side of O set off half the width of the rail. Then the width of the mould at A C, and the bevel for the joints are found at Fig. 2, by taking D for centre, and for radius, a tangent curve, A C cutting at W; join W A, and in the angle is the bevel, from which the width of the mould is given. The mould for the piece of wreath landing. Let Fig. 4 be the board for this; make R N equal P B, Fig. 2; make R B equal P R, Fig. 2; draw B P parallel with R N; draw P N produced. Find the width of the mould at N, by setting off half the width of the rail from P, Fig. 2; square this down to cut the pitch, which gives half the width of the mould; this set off on each side of N; draw the straight wood parallel with N P; set off half the width of the rail on each side of B. The bevel for the wide end of the mould is in the angle B R P, Fig. 2.

The mould for the piece of wreath starting from the newel. This is found by drawing a line to represent the top of the first step, seen at Fig. 3. Make S 2 equal three risers; make 2 N H equal 2 N H on the plan; draw 2 T parallel with P A, Fig. 2; draw N T parallel with 2 S. Then T N is the height, and the distance from the top of the step to the centre of the rail at T added to the length of a baluster, will be the height of newel, half the thickness of the rail less. The tangent N H, Fig, 1, produced, is the ordinate. From the centre of the joint 2, draw a line parallel with H N; make H C square with H N; make H T equal T N, Fig. 3; join T C; square over lines from T and C; make T A equal H N; make C B equal C 2; join A B. This, to be correct, must equal T 2, Fig. 3. Now draw a few ordinates, and trace the mould. The bevels are found and applied in the same manner as has been given.

PLATE XVIII.

Fig. 1 exhibits the plan of stairs, with winders and square tops. The concave or outside rail is only given. It will be seen that the ends of the winders on the circle are wider than the square steps, so that the rail on this part must have a different pitch from that on the square steps. The meeting or junction of two pitches form a ramp or easing. In order to make one mould answer for the two pieces of wreath which connect with that in the centre, let the joints be of equal distance from the springing line, that is to say, from 2 and 8 on the plan. Assume the joints to be 4 and 6; then the tangents are 2 3 4 5 6 7 8; these unfold at Fig. 2, indicated by the same numbers. Make the elevation of the winders with one or two square steps at the lower and upper ends; let the under side of straight rail rest on the balusters B B; set off half its thickness; this draw to cut at P and X; join P X, and we have the pitches. The joints are at A and K; square over K 2 cutting N. Now at Fig. 1, make 4 X equal N 2, Fig. 2; from X draw a line through 2 indefinite. This is the ordinate. Draw lines from 3 and 4, parallel with it; draw 2 A square with V 3; make 2 S equal T 2, Fig. 2; join S R. From H R P, draw lines square with H P; make H K equal V 3; make R J equal R 4; join S K and K J produced. Now draw ordinates, and trace the mould as usual. The bevels are found and applied in the same manner as if it were a piece starting from a newell.

The mould for the centre piece of wreath is obtained at Fig. 3. Draw the line P R square with 5 C; make 5 W equal 5 C. Then at Fig. 2, take W K or W A for radius; with this, and W, Fig. 3, for centre, intersect the line through 5, at P R; join W R P. Find the bevel for the joints, by making W S equal 5 6 on the plan. Then take centre O, Fig. 1, and for radius, a tangent curve, with W R cutting at T; join T O, and in the angle is the bevel. On each side of O set off half the width of the rail. Find the width of the mould at the ends, from the bevel; make its joints square with the tangents. A straight-edge will be most convenient to strike this mould.



Scale ¾ to the foot

R Riddell

PLATE XIX

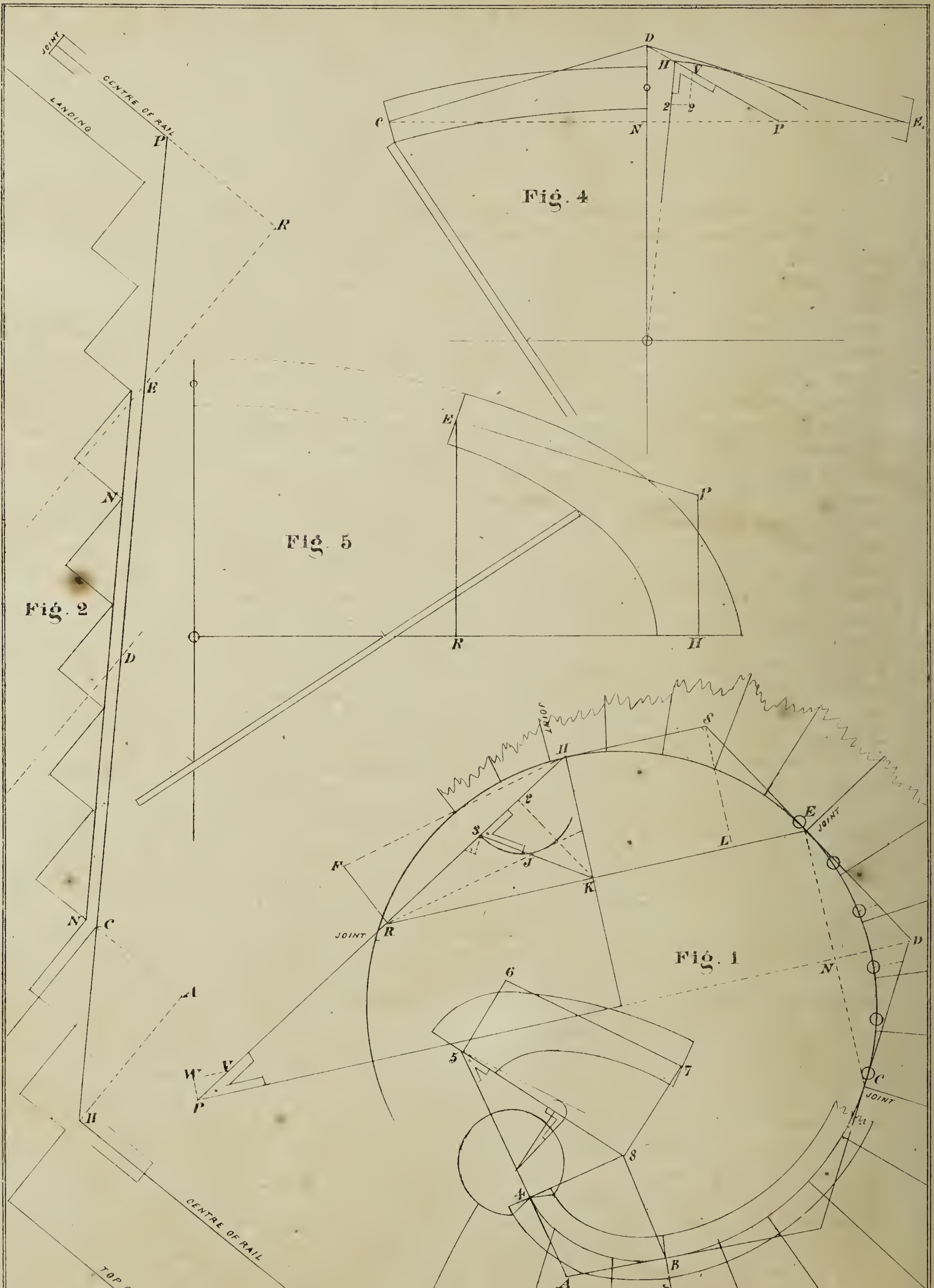


Fig. 4
D
H
V
2
2
C
N
P
E
Fig. 5
E
P
R
H
Fig. 2
JOINT
CENTRE OF RAIL
LANDING
P
R
E
N
D
N
C
A
H
CENTRE OF RAIL
TOP OF FIRST STEP
Fig. 1
JOINT
H
S
2
3
J
K
L
E
JOINT
F
JOINT
R
D
N
6
5
7
C
JOINT
W
V
P
8
4
A
B
JOINT
Scale 1 in to the foot
R. Kiddell

PLATE XIX.

Fig. 1 exhibits the ground plan for a circular staircase, starting from a newel.

It will be observed that the rail and string from the joint B, is a different curve from that of any other part of the plan. This is purposely done, in order that the wreath from the mitre-cap may have a proper easing. This arrangement will add much to the appearance of the stairs, giving a bold and graceful outline at the starting. Have the joints in such a position that one face mould will answer for all the wreath pieces, except that starting and landing. To do this, suppose we say the joints are B C E H. These being determined, show that there are two steps from H to the landing, and from top of first step to B, there are three risers, so that between B and H each piece of wreath stands over five risers. The tangents are drawn through the centre of joints. Make the position of the balusters on the centre line of rail; draw the dotted line O D. This being the ordinate. Draw a line from centre of balusters to cut the tangents, parallel with O D. Now, an exact elevation of the balusters can be made as they stand under the rail, simply by unfolding the tangents C D E, on the same principle as laying out a string. This is seen at Fig. 2, indicated by the same letters as those on the plan. The position of the balusters are given, being transferred from the tangents, also on the plan. Make the elevation of the two steps from H and the landing. Make the elevation of three risers, and top of first step starting; make the under side of the wreath landing equal to half a riser above the floor; set off half its thickness; this draw to cut R. Let the under side of the rail rest on centre of balusters N N; set off half its thickness; this draw to cut P and H. From H draw centre of rail. The elevation being finished, the moulds are now easily obtained. That for the five winders are found at Fig. 4, by making O N D equal O N D, Fig. 1. Through N draw a line indefinitely, and square with N D. Then, at Fig. 2, take D E or D C for radius, with this and D, Fig. 4, for centre, intersect the line through N, at E C; join D E C. Make O O equal the radius on the plan. On each side of O set off half the width of the rail. Find the bevel for the joints, by making D P equal D E on the plan. Then take O for centre, and for radius, a tangent curve, with D E cutting at H; join H O, and in the angle is the bevel for each joint of the wreath. To find the width of the mould, make 2 2 equal half the width of the rail; draw this parallel with 2 H, to cut D P; then H V is half the width of the mould, which set off on each side of C and E; make the joints square with the tangents; strike the mould.

The next mould will be for the piece of wreath that stands over S H, on the two steps landing. At Fig. 1 draw E K R parallel with S H. From centre O draw a line to cut at H, and square with K E; make K R equal E R, Fig. 2; from H draw a line through R cutting P. This is the major axis. Then make O R H, Fig. 5, equal P R H, Fig. 1; square over the lines; make H P equal S H, and R E equal K E; join E P. This, to be correct, must equal E P, Fig. 2. Make O O equal to the radius on the plan. On each side of O set off half the width of the rail. Find the width of the mould at H, by making P W, Fig. 1, equal half the width of the rail; square this down to cut at V; then P V is half the width of the mould; this set off on each side of H, Fig. 5. Find the bevel for the joint E. From any part of the major axis, say 2, Fig. 1, draw a line square with 3 H cutting at K; make R F parallel with 2 K; then make R F equal L E; join F H; draw R J parallel with it. Take 2 for centre, and for radius a tangent curve cutting at 3; join 3 K, and in the angle is the bevel; that in the angle at P is for the joint H on the wreath. Make the joint E square with E P. Now take a straight-edge and strike the mould.

The next mould will be for the piece of wreath starting from the newel, Fig. 1. The ordinate for this is A 4 5. Draw B 8 parallel with A 4; make 4 8 square with 4 A; make 4 5 equal H A, Fig. 2; join 5 8; square over 5 6 and 7 4; make 8 7 equal 8 B, and 5 6 equal 4 A; join 6 7. This, to be correct, must equal H C, Fig. 2. Draw a few ordinates, and trace the mould; make joint 7 square with 7 6. The bevels for each joint are seen in the angle 4 5 8. These are found as usual. The application of the mould and bevels is the same as has already been given. The application of the mould on the plank is simply tangent over tangent, that is to say, the bevels give a direction to mark the same tangent on the surface of the plank as that on the mould.

We do not think it expedient to extend this subject any further, as it would only be a useless repetition of words and drawings, to little or no purpose. The first plate of this work embodies all we have done, and is the basis for the proper construction of any wreath, no matter what its form may be.

PLATE XX.

Before entering upon a description of this plate, it may be proper to state, that I have taken the privilege to press into the service of this work any thing that will make the art of staircasing as easily understood as any other part of carpentry. This is for no aim at novelty merely as such, but because many parts of carpentry are identical with handrailing, and none more so than that of roofing; especially the cut on the end of a jack rafter which forms the parallelogram and its sides or angles, is the exact counterpart of the tangent lines on the face mould. Again, the line from which the length of the rafters is obtained, may be considered equivalent to the directing ordinate. In short, the construction of a common roof is such that every candid workman must admit its similarity to the principle on which face moulds are found. But our meaning will be better understood by an examination of Fig. 1, which is the common hip-roof. Let A D H be the plan of the hips, and D E the rise of the roof. Now suppose the length of one rafter be required; for example, that of 2 3 or B C, which is the same thing. Then make C K square with A D, and C P square with B C; make C P equal C K; join P B; this is the length of the rafter. To find its length and all the others on a flat surface; produce the base B C; then take B for centre, and P for radius; draw the circle, cutting at N; now draw the produced line A N; this may be called the ordinate, from the fact that it gives the length of all the rafters. The side bevel is contained in the angle A B N, and the down bevel in the angle B C P. Suppose the end of the rafter cut by these bevels, and that A B C D, Fig. 2 is its section, we must now prove the sides to be tangents to the ellipse, and the points of contact, or where the curve touches, to be 3 2 L S. To do this, find the major and minor axes, by drawing L H perpendicular to C D; make L H equal S R; join H R; bisect this at V; draw V K square with V H; take K for centre, and H for radius; draw the circle, cutting at T. Then draw the produced line T R, and we have the minor axis. Draw the major axis R N at right angles to it; draw L N parallel with R H; make R P equal N L; set the trammel and describe the ellipse, and the curve will touch the points 3 2 L S. The illustration of this problem teaches the simple truth that every face mould is nothing more or less than the section of a jack rafter, so that we must abandon the absurd notion, that handrailing is the summit of the joiner's art. Were we not limited in the extent and price of this work, many examples of carpentry could easily be given, the construction of which require more mechanical skill and judgment than is ever devoted to any staircase, however complicated.

PLATE XXI.

Fig. 1 exhibits a neat and off-handed method for finding the mitres of mouldings in angular framing. Take B for centre, and with any radius draw the semi-circle, cutting at A C; make B D the same rake as 2 3; then join C D A, and in the angles at A C are the bevels for the acute and obtuse mitres.

When the framing is both straight and circular, as seen on the diagram, then the mitres on the mouldings must be circular, in order that the members intersect. This is obtained on the same principle as finding the centre for a circle that shall pass through three given points similar to A B C, Fig. 2.

Fig. 3 shows the method to fit a board when slanting, to a column or post, whose diameter is P L. Suppose the line 2 3 is the distance that the board is to fit the column, and S C B the given slant; then let Fig. 4 be the board; make A B C equal A B C, Fig. 3; also, make H K equal P L. Now, notice at Fig. 3, that B C is the upper side of the board, and T R the under side, so that by setting the trammel to A C and A K, Fig. 4, and drawing the curve to the edge of the board B, we have a direction to cut from the upper side; then turn the board up side down, keeping the edge in the same place as at first. The trammel is set to the distance A D, (remember, A K remains unchanged;) draw the dotted curve, and this is the line for the under side.

PLATE XXII.

Exhibits a simple and easy method for finding the boards for circular work, when on the splay or rake. This will be found extremely useful for various kinds of lining, such as the angles in rooms, when required to be circular and on the rake. It will also apply to the lining of bath tubs or the end of a circular counter, having its top projecting beyond the base. For example, let E D be the base, and K A the projection, and A B the given height. Make B C equal A D; take A for centre, and C for radius, cutting at B; then take O for centre, and B for radius; draw the outside circle; this gives the length of the boards, when standing on the rake at A C; then set off the width of the boards on the base. Draw lines from O, through the divisions made on E D; then make the width of the boards on the outside circle the same as on the base, so that when the boards are in position, the narrow ends stand on the base E D, and the wide ends fall on the given rake, and fill the circle K A. This will be found extremely useful for many purposes.

Fig. 2

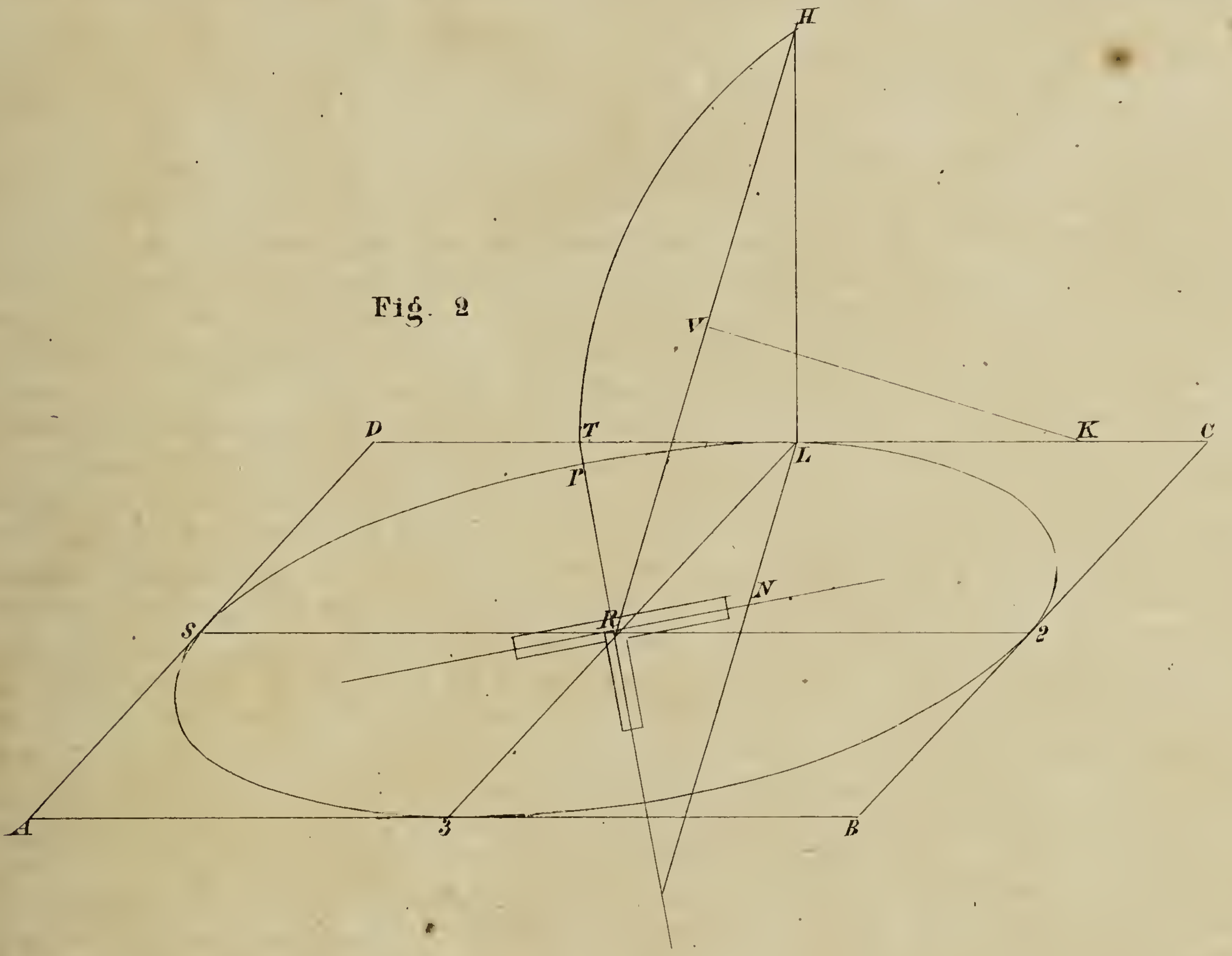
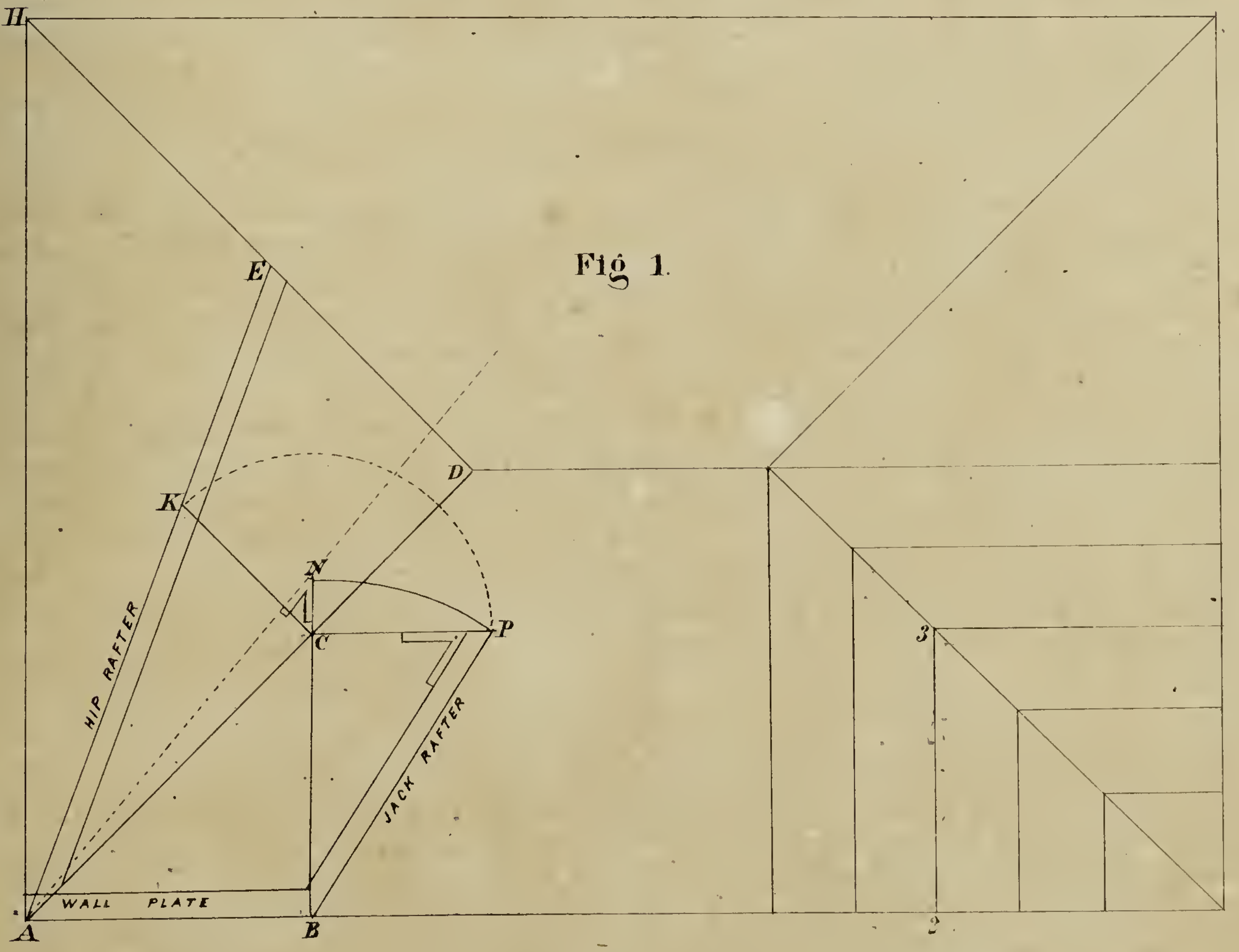
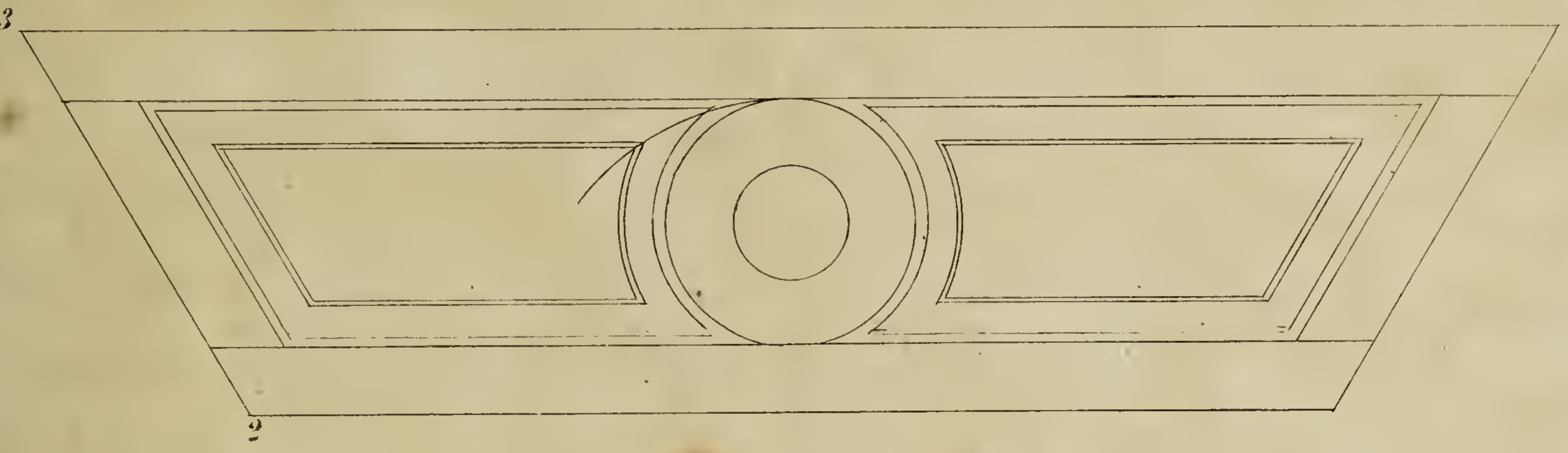


Fig 1.



R. Riddell.

PLATE XXI



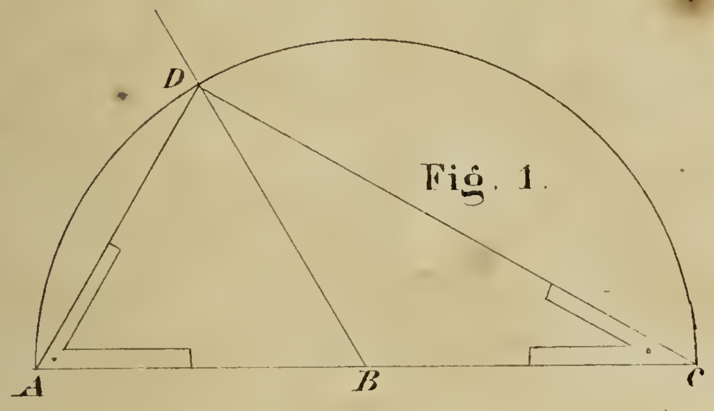


Fig. 1.

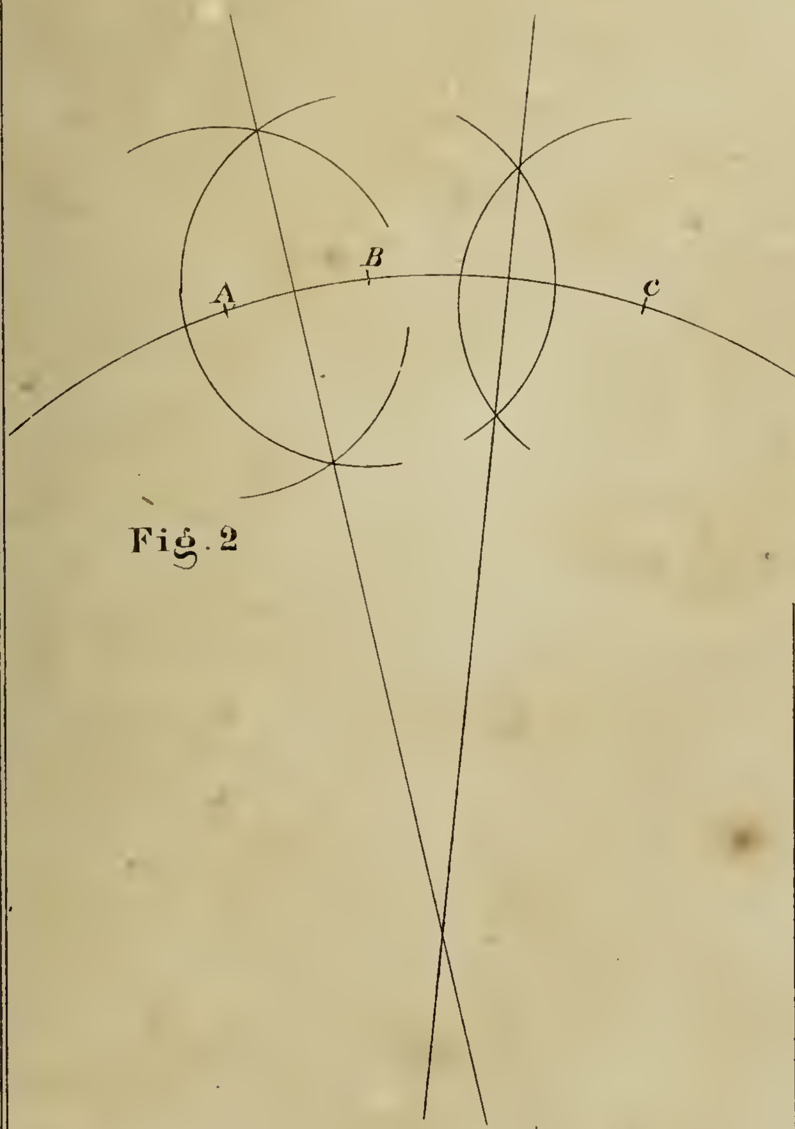


Fig. 2

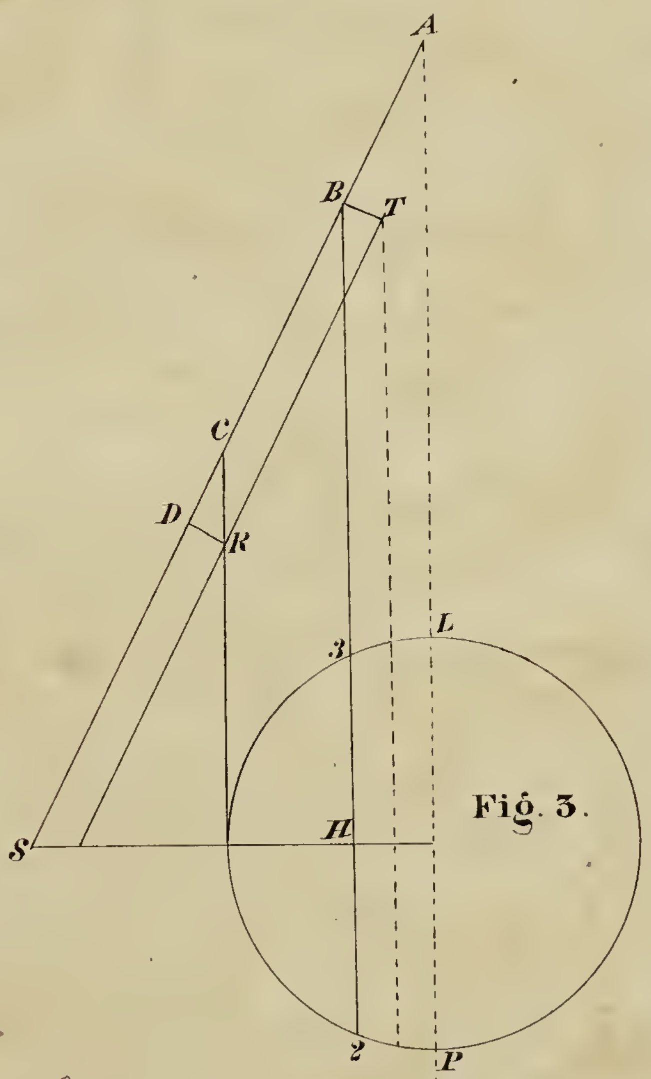


Fig. 3.

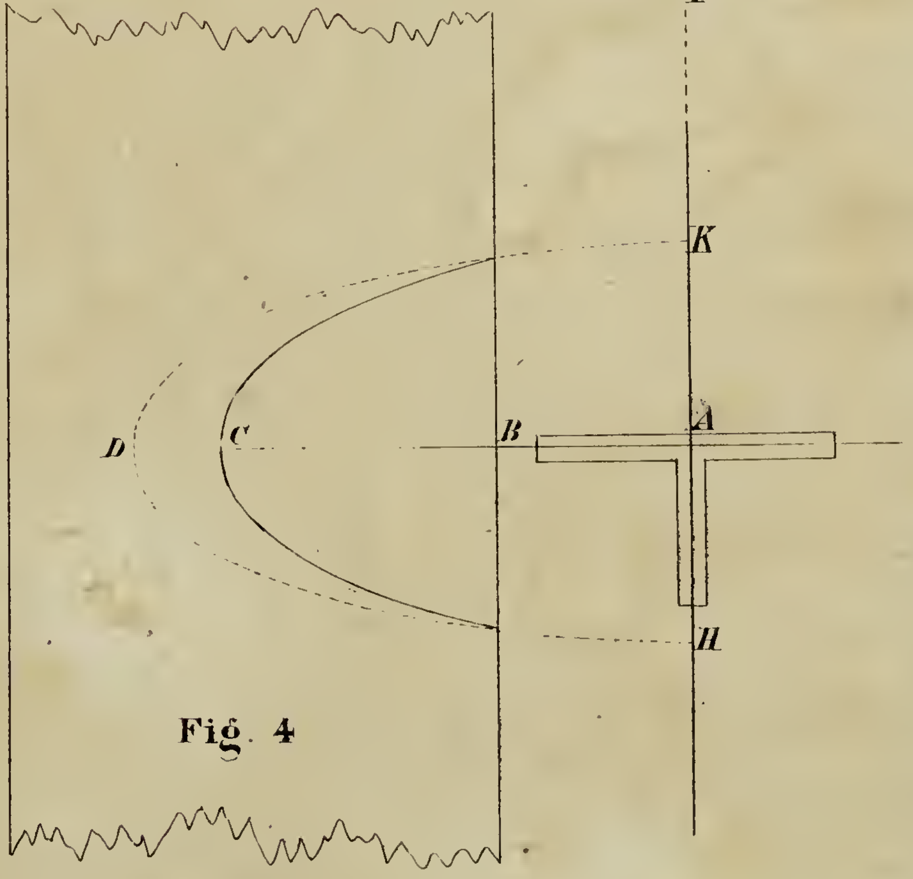
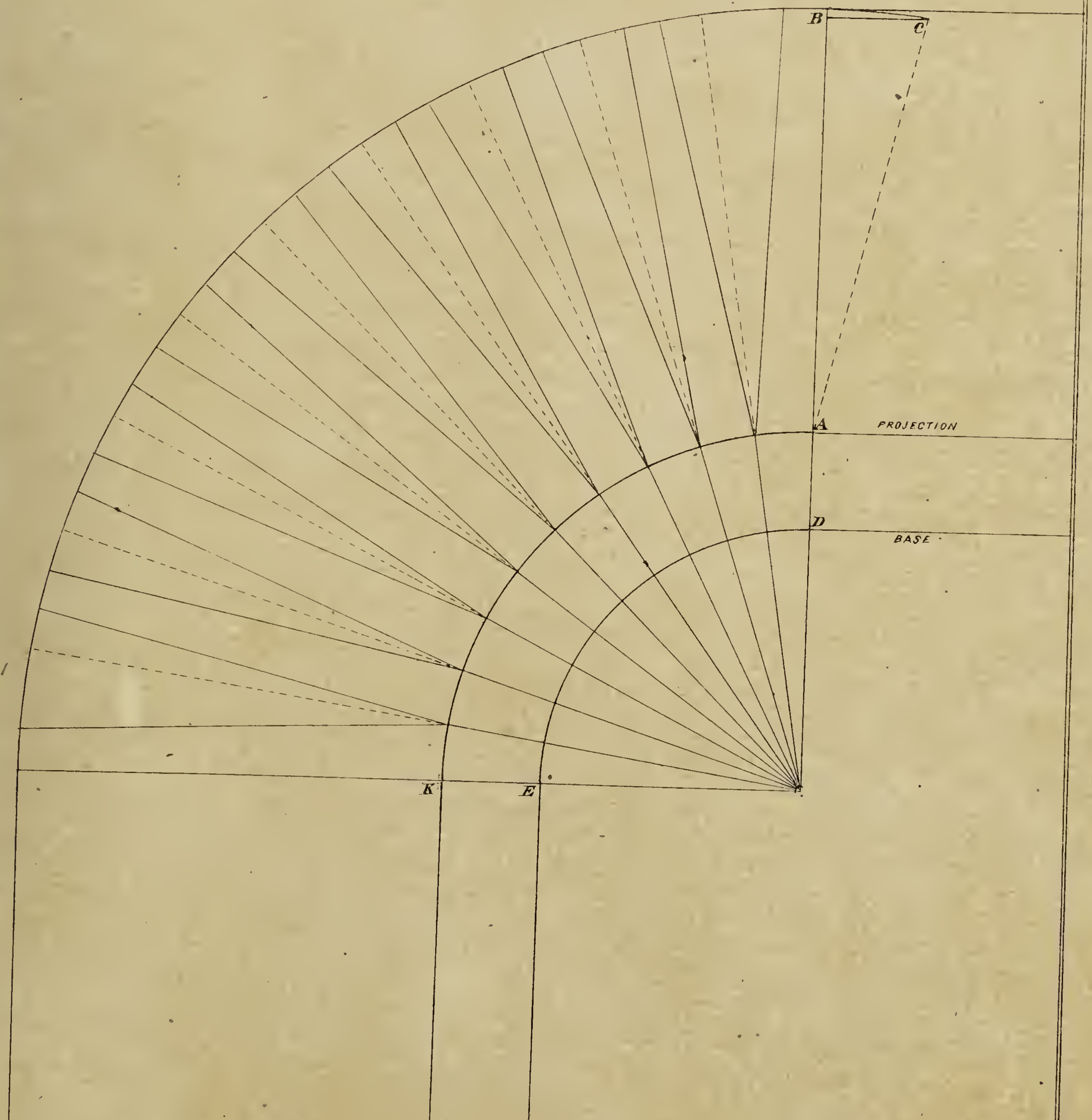


Fig. 4

R. Riddell

PLATE XXII



R Riddell